U.S. ARMY-BAYLOR UNIVERSITY

GRADUATE PROGRAM IN HEALTH CARE ADMINISTRATION

DEVELOPING A FUNCTIONAL WAYFINDING SYSTEM FROM THE EXISTING SIGNAGE SYSTEM AT MADIGAN ARMY MEDICAL CENTER

A GRADUATE MANAGEMENT PROJECT

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BY

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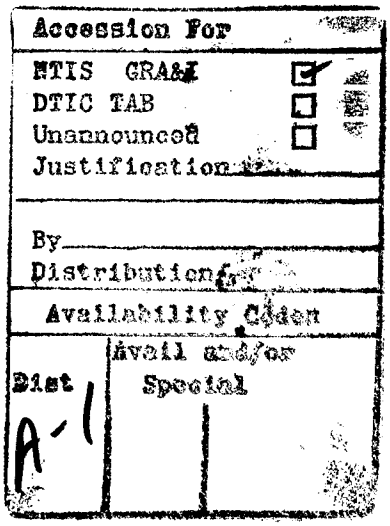
ABSTRACT

Madigan Army Medical Center, the newest Department of Defense tertiary care teaching center, was identified as having a problematic wayfinding system by several sources. Wayfinding, a relatively new term used to describe the act of processing spatial orientation cues inside an architectural facility (finding one's way), has amassed a considerable amount of literature in a short time span. A Post Occupancy Evaluation of the facility suggested further study on the issue. Two survey instruments were designed to assess the current status and magnitude of the problem and were administered throughout the entire facility. Responses from the patient and visitor survey (N1=875) and from the staff survey (N2=147) provided useful information on trends, problem areas, customer insights and preferences, and suggestions for improvement. A self assessment checklist on wayfinding found in the literature was also used to identify problem areas, validate trends in the surveys, and suggest improvements. Six courses of action were developed to address the identified problems. These alternatives were evaluated via a weighted, multi-criteria decision matrix. Nineteen criteria were developed from the literature and staff input. The "best" alternative, as identified by the decision matrix, was developed to be presented, with additional recommendations to the executive committee.



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INTRODUCTION

Madigan Army Medical Center (MAMC), located at Fort Lewis, Washington is a teaching facility and tertiary-care medical referral center. It has regional responsibility for seven states in the Pacific Northwest including Alaska, Washington, Oregon, Idaho, Montana, Northern California, and Nevada.

Madigan, a 1.2 million square foot, 414-bed, $280 million complex, remains the newest and most modern Department of Defense medical center. Army planners decided to replace the old Madigan Medical Center, a 1944 vintage, one story, 120 acre, multi-corridored medical facility, and the project was funded in 1980. Construction started in 1985 and the new Madigan Army Medical Center opened on 28 February 1992.

Designed and constructed for aestheticism as well as functionality, Madigan operates with state-of-the-art technology in both clinical and administrative support areas. Technologically advanced clinical systems include the Medical Digital Imaging System (MDIS), a networked Clinical Information System, and Magnetic Resonance Imagery (MRI). Leading edge architectural designs include interstitial space between each floor, computerized cart delivery supply systems, pneumatic tube and rail cart messenger systems, and a drive-through pharmacy. In addition to the eight inpatient floors, there is a detached MRI complex, and a three story ancillary building and medical mall with an automatic skylight system and escalators. The Central Materiel Service (CMS) has a dedicated, sterile elevator shaft that allows sterile supply carts to be delivered directly into two floors of operating room sterile cores. A clear, well-water stream emptying into a large collection pond flows between the medical mall and the rest of the center

doubling as a picturesque attraction for patients and a heat-exchange cooling system for facility ventilation. All designs were planned with the intent to maximize efficiency, productivity, and comfort for patients and staff.

Madigan's clientele include all beneficiaries in its designated catchment area, patients from the seven state health service region, and select patients transported here from the Pacific theater. Pools of patients come from Mountain Home, Malstrom, Fairchild, and McChord Air Force Bases; Bremerton, Seattle, and Whidbey Island Naval Facilities; the Coast Guard's Thirteenth District; and the Public Health Service. The catchment area population consists of 236,856 Department of Defense beneficiaries made up of active duty soldiers and their dependents as well as retirees and their families. Madigan amasses over a million outpatient visits and 21,000 admissions annually. Its number of outpatient visits is exceeded in the Department of Defense only by Wilford Hall Air Force Medical Center in San Antonio, Texas.

Madigan has standing affiliations with over one hundred schools and hospitals; fifty schools and universities send students here for training. It is also one of the largest medical training centers in the Army. There are currently seventeen medical residency programs and ten fellowship programs that are filled by 251 physicians. Other active training programs include the second phase of the nursing anesthesia program, a perioperative nursing course, phase two 91C course (Army licensed practical nurse), and other medical specialty courses. Phase I, II, and operating room refresher training for the enlisted medical proficiency training (MPT) program as well as programs for physician assistants, podiatrists, psychologists, and administrators are overseen by the Madigan teaching staff. The entire staff consists of over three thousand civilian, officer, and enlisted employees. The staff routinely experiences a significant turn-over rate in military personnel and patients due to the nature of a military lifestyle. This turnover plays a significant role in wayfinding that is usually not encountered at civilian medical facilities.

Conditions Which Prompted the Study

Although modern and well planned, Madigan has a readily evident problem that affects new and seasoned staff, patients, their visitors and companions, and vendors. While there are "you are here" maps and numerous directional signs placed at seemingly strategic points throughout Madigan, they often fail to adequately assist "lost" people in finding their way. Experts maintain that facility managers usually know when they have a problem simply by casual observation of the number of times personnel with badges are stopped for directions by patients and visitors (Eubanks 1989, 22).

This situation formally manifested as an institutional problem when the Deputy Commander for Administration (DCA) received correspondence through the Department of Nursing from a head nurse. The Head Nurse had received numerous complaints from her staff on Ward 2 South concerning lost patients and visitors since Madigan was occupied. These complaints became critical to the 2 South staff when fourteen visitors requested directions on a single Saturday. The 2 South staff initiated an informal collection of data on 129 "information seekers" for a twenty-three day period. A summary of their report offered several conclusions, recommendations, and an analysis of cost and other implications to Madigan should the problem not be corrected.

A Total Quality Management (TQM) focus group met to consider the issue. This group consisted of the DCA, the Madigan Provost Marshal, the Chief of Ambulatory Nursing, a facility engineer, and the Chief of Logistics. Before requesting establishment of a formal Quality Action Team, the focus group decided to collect more data throughout the facility. Another data collection effort was conducted by the Madigan Provost Marshal. Two simple surveys were conducted at both facility information desks from 3 to 11 June 1993. The desk workers were asked to tally all requests for directions during this period. While the construct of the survey process is questionable (incomplete data, incomplete information on instructions to workers, too

few destinations on the tally sheet, etc.), the sheer number of requests for direction seems to substantiate wayfinding as a problem. The information desk in the nursing tower received 423 requests (for an unknown number of operating hours) and the medical mall information desk received 1,459 requests. A follow-on study was attempted at the outpatient clinics to ascertain if those patients had encountered difficulty finding their way to the clinic. This survey was very limited in that it solicited simply a "yes or no" answer to whether the patient experienced difficulty finding the clinic and asked what facility location the patient was in before coming to the clinic. The survey was only completed by one clinic in enough detail to provide any useful data.

Concurrent with this second data collection, the facility engineers identified deficient project signage to inspectors who were conducting a Post Occupancy Evaluation of the facility. They also sent correspondence to the Corps of Engineers, Seattle District Office, requesting assistance from the Architect-Engineer in identification of "corrective actions necessary to eliminate wayfinding confusion at the Madigan Army Medical Center." Some of the problems identified in the memorandum included: (1) signage is difficult to see or find since it is mounted flush to walls and doors; (2) signage was not provided for stairs, phones, fire extinguishers, etc.; (3) wayfinding via long, circuitous routes through the center are cumbersome and not well focused on patient needs; (4) directory signs are difficult to [use] due to their general direction and low contrasting color scheme. Based on these actions, the Corps of Engineers agreed to provide Madigan with two Architect-Engineer consultants to assist in problem solving. Their requested scope of service included serving as team members, investigation of on-site conditions, and development of corrective options. Each corrective option would include specific scope development, bill of material definition and availability, as well as cost estimates.

The finalized Post Occupancy Evaluation report (Medical Facilities Acquisition Board 1993, paragraph 3.3.2. SIGNAGE and 3.3.3. ART) addressed the wayfinding problem in a two page section of the report. Specifically, it mentions problems associated with wayfinding, readability, contrast, lack of facility standards for informational signs, standardization of room

signs, sign modification, location, interchangeability, general upkeep, and updating of signage. Signage was also classified as not being "tactile as required by current criteria [because it] had been interpreted as not required at time of design." The evaluators felt that the use of photographs and artwork in some areas of the facility aided in wayfinding. They reported that the graphics helped integrate the facility colors and provided continuity of design within the facility which also helped identify the signage as a focal point. The evaluation further recommended that Madigan initiate a study to determine the best way to overcome the deficiencies. Concerns identified for future projects were:

1. Color contrast between sign message and sign background [should] be greater to improve visibility.

2. Color contrast between sign background color and wall or door finish color needs to be greater. In some instances, the signage disappears on the wall because of low contrast.

3. Color contrast between department signage copy (vinyl) and wall color needs to be greater. At MAMC the signage copy is white and the wall color is off-white, making it difficult if not impossible to see.

4. Where appropriate to the design intent, building graphics (color, size, type, etc.) could be designed to aid in wayfinding.

5. The system/program for revisions to signs needs to be better defined and shared with users. This would reduce improper signage and expedite not only revisions but relocation, information updating, and installation of new signs.

6. Building directories with floor plans at kiosks and main entrances need to be designed so they can be easily changed. These are currently permanent and will be costly to revise and replace.

7. Facility standards should be developed for informational signs (i.e. hours of business, instructions, etc.) required by users to eliminate the clutter and poor appearance created by these types of signs.

8. A bed number sign should be located in patient rooms at bed locations, wardrobes, and nurse servers.

9. Extra stock signs and inserts should be provided as part of any future signage package to aid in future alteration of signs.

10. The part of the sign directly behind the sign insert should be the same color as the background color of the sign. When the sign insert is removed, the overall sign color will remain the same.

Madigan's wayfinding deficiencies were set aside as a low priority for a period of time after the focus group met in order to devote staff resources to other priorities such as a Joint Commission Survey. Little analysis on this issue has been conducted since then by management. All available information on actions that had been previously undertaken by the staff was collected. The patient representative office was contacted to find out if their database contained any patient complaints on wayfinding. Unfortunately, their database is only set up to allow queries for the *primary* complaint. It is reasonable to assume that patients do not seek out a patient representative to complain about a problem (wayfinding) that is just as easily solved by asking a staff member in a hallway for directions. The database provided no primary complaints about patients being lost. It did, however, quantify the number of "other contacts" handled by the two staff representatives from October 1992 to September 1993. An "other contact" is any interaction with a patient at the patient representative office that cannot be categorized as a complaint, request for assistance, or compliment. The representatives estimated that *at least* 90 percent of the "other contact" visits were requests for directions by patients and visitors. This category far exceeds any other category in number of visits and averaged 336 visits per month for

a twelve month period. Assuming the estimate provided by the representatives is accurate, lost customers accounted for 3,627 (0.9 * 4,030 "other contacts") out of a total of 7,319 patient contacts for the year.

Statement of the Problem or Question

What is the best recommendation to the executive committee on how to improve wayfinding at Madigan Army Medical Center for patients, their visitors and companions, the staff, and vendors?

Literature Review

Wayfinding, a relatively new term, is first found in architectural literature in a 1960 book by Kevin Lynch, *The Image of the City* (Arthur and Passini 1992, v). It didn't gain any significant popularity as a methodology, though, for another quarter of a century when Romedi Passini published *Wayfinding in Architecture* in 1984 (Arthur and Passini 1992, v). Passini extended Lynch's concepts from application of the design of a city (an external application) to an internal application of design *inside* a facility (Carpenter 1989, 94). A year later, Janet Carpman, Myron Grant, and Deborah Simmons completed a research report at the University of Michigan called *No More Mazes: Research about Design for Wayfinding in Hospitals* (Carpman et al. 1984). These two works were devoted to wayfinding as a significant architectural design issue and were followed by numerous articles on the subject from 1988 until present.

Wayfinding gradually started replacing the term "spatial orientation" in the late 1970s and is considered to be a new approach to studying and understanding peoples movements and their relationship to space (Arthur and Passini 1992, 22). The method by which people reach a destination, wayfinding as a process is made up of decision making, decision execution, and information processing (Arthur and Passini 1992, 25). While seemingly simple tasks, the ability of people to know where they are, know where they are going, know and follow the best route to that destination, recognize the destination upon arrival, and be able to find their way back is actually a complex series of cognitive processes involving spatial orientation, problem solving, and cognitive mapping (Grant and Carpman 1988, 45)(Arthur and Passini 1992, 23, 27). Cognitive mapping, a central component to the wayfinding process, involves creating a mental image of the environment, its landmarks and regions, and the spatial relationship between them (Weisman 1989). Since people substantially rely on what they know (but not necessarily see) about a city layout while maneuvering from one point to another, effective wayfinding requires that people know the location of places now out of sight and how to get to them (Weisman 1989).

Elements of a good wayfinding system might include the layout of the building, directional signs, directories, sensory cues, "you are here" maps, terminology, floor numbering, room numbering, verbal directions, and easily recognizable landmarks (Carpman et al. 1984, 29)(Grant and Carpman 1988, 46). It is particularly important for these elements to be mutually reinforcing because no single component of a system can, by itself, solve a facility's wayfinding problems (Carpman et al. 1984, 29)(Grant and Carpman 1988, 46)(Martin 1993). In fact, Passini concluded that there must be three elements present in a complex facility for people to find their way: graphics, architectural layout, and verbal communication (Carpenter 1989, 92). Signs, while extremely important, are not sufficient by themselves. In complex buildings such as large medical facilities (Roebuck et al. 1987, 239) it may not be possible for even large numbers of graphics to provide wayfinding performance as good as that found in a simpler facility with no signs at all

(Weisman 1989, 114). In fact, trying to improve wayfinding by simply adding more signs can create an atmosphere of "information overload" which can be more confusing for users than before they were installed (Weisman 1989, 114)(Arthur and Passini 1992, 35). Malkin (1992, 462) claims that "less is definitely more" when referring to signage. Many hospitals err when they attempt to direct traffic to every possible room and destination beyond a directional sign. Research indicates that people tend to ignore directional signs having more than seven posted locations. The research concludes that facility destinations should be ranked by priority of traffic volume and only the most important should be listed on major directional signs. It should be understood that there will always be some people who will need assistance in finding their way regardless of the quality of the wayfinding system. If only sixty to seventy percent of customers find their way with a wayfinding system that is focused on the high volume destinations drawing sixty to seventy percent of customers, then remarkable benefit has been achieved for the organization (Malkin 1992, 463). As an example, "staff only" destinations should be omitted from major directional signs.

This aspect of wayfinding, that performance varies positively with respect to the number of mutually reinforcing components, should be useful if management desires to improve wayfinding in their facility without incurring the potentially massive costs of structural change. In a study of a nursing home, Weisman (1989) found that more than seventy-five percent of the orientation aids used by patients were not signs but "distinctive elements within the environment, such as plants, a grandfather clock, or the elevator [which]... served to differentiate one space and corridor from another..." These landmarks tend to be powerful wayfinding tools upon which a wayfinding system can be based if a building's architectural layout is complex or otherwise confusing.

Although wayfinding may be a relatively new methodology, it seems to have gained a strong foothold in the architectural community and stronger support in related graphic design firms. The Society for Environmental Graphic Design (SEGD) devoted an entire annual

conference to wayfinding in 1988 and many professional designers now understand the problems encountered by people finding their way, the wayfinding process, and the development of complementary architecture and graphic design essential to adequate wayfinding (Weisman 1989). Passini wrote of concepts that might now seem obvious, but his theories were extremely insightful at the time. To facilitate incorporation of wayfinding in design, architects had to first understand *how* people found their way. Carpenter likened Passini's work to a medieval monk who announced that he was going out to the barn to count how many teeth horses had in the midst of a philosophical debate on the subject (Carpenter 1989, 92).

A key component to the issue of wayfinding is why it is important and, of equal importance, what it is worth. There were several reasons that were common to almost all of the literature on wayfinding. These included lost staff productivity as they provided directions to patients and visitors, patient and visitor stress and frustration, poor quality of care if emergency access is compromised due to poor wayfinding, and potential loss of customers. Saegart (1970) identified six types of stress attributable to the environment. One of these, termed "suitability of the environment," referred to the ability of the environment to support or frustrate people's goals such as in poor wayfinding at a complex hospital. A study by Robert Dewar established that almost a third of the staff of a Canadian hospital were approached at least once daily for directions (Weisman 1989, 113). Arthur and Passini (1992, 9) mentioned a study of an 800 bed facility where no less than 8000 hours (four person-years) of professional time were lost in redirecting patients and visitors. Another study of the Dallas-Fort Worth Airport established that twenty-five percent of all travelers had problems with signage and twelve percent found the airport confusing. These percentages become even more disturbing when they are applied to a population of greater than 75,000 customers served daily by the airport (Weisman 1989, 113). Carpman, Grant, and Simmons interviewed visitors to a hospital that was undergoing refurbishment. Their surveys indicated that the single most important predictor of customer stress

was the degree of difficulty encountered in the facility with finding their way (Carpman et al 1984).

There are numerous claims in the literature of benefits gained by improving wayfinding. These range from improved staff productivity, better traffic flow, and improved public relations (Anonymous 1982). Other authors conclude that poor wayfinding can diminish quality of care provided. One example, provided by Carpman (1991, 24), involves physicians unable to spend as much time with patients as they would if the patient was not late for appointments due to a poor wayfinding system. Another involves the serious medical and legal consequences that might be encountered if an emergency patient receives delayed care, a Code Blue team takes a wrong turn, an angina patient cannot easily find the Cardiology Clinic, or critical lab specimens are delayed by a new messenger who has lost his way (Grant and Carpman 1988, 45). Grant and Carpman (1988, 45) estimated lost staff productivity to potentially cost in excess of $80,000 per year.

Under normal circumstances, losing your way is probably merely an annoyance; in a hospital, anxiety can impair the ability to process information which serves to exacerbate the problems of poor wayfinding systems (Malkin 1992, 447). Several authors warn that poor wayfinding experiences are not easily forgotten or forgiven by customers, a factor that can establish direct and indirect costs for the facility. Patient stress and visitor frustration might cause anger, hostility, discomfort, indignation, and even panic. These reactions can manifest themselves as overall hostility towards the organization (Carpman et al. 1990, 30).

An important reason to implement improved wayfinding is to enhance the marketability of the facility. A recent trend in America is that people are increasingly viewing themselves more as customers seeking the best value than as patients and visitors resigned to endure whatever inconveniences and indignities providers heap upon them (Grant and Carpman 1988, 45)(Carpman 1989, 45). Similarly, some management has joined the movement and is starting to try to see the healthcare process through their "customer's" eyes. Leaders in the Department of Defense health fields should consider the recent decision by the Department of Defense to

implement the TRICARE system of healthcare for eligible beneficiaries. TRICARE is expected to offer beneficiaries a **choice** of receiving care from a civilian Health Maintenance Organization, a civilian Preferred Provider Organization, Standard CHAMPUS, or from the traditional care setting such as is available at Madigan (OASD-PA 1993). It should be clear that Madigan could lose a substantial amount of business if its customers are unhappy with the service provided. It follows that management must consider the implications of potentially unsatisfied customers as a result of bad experiences with wayfinding. As Janet Carpman stated:

> Quality medical care is always viewed as having a greater value than the physical environment in which it is provided. Therefore, the physical facility, in a marketing context, is more likely to be a potential barrier than an attraction. When the perception of medical quality among competing hospitals is nearly identical, however, questions of access, comfort, and facility attractiveness become important - if not crucial - to the consumer's choice (Carpman 1989, 53).

There is also (hopefully) an inherent organizational desire to ensure that service provided to customers is of the highest possible quality. Madigan employs a TQM philosophy that is committed to continuous quality improvement (CQI). An implied goal of this philosophy is to demonstrate to the public that Madigan is a well organized, professional facility that cares about its patients and the quality of care. In this regard, management should be interested in improvement (of wayfinding) simply because it is needed, good for the institution, and best for the customer. *How* interested management is will probably be directly tied to *how* bad the problem is and *how* much the improvement will cost. There is no doubt that management will evaluate this need against competing needs for scarce resources. As they evaluate, though, they should bear in mind that wayfinding is not simply a "nice to have" item; in fact it is a *need* of patients and visitors. Through a series of patient/visitor preference studies, Carpman et al. identified that their customers had four basic needs in facility design (Carpman 1989, 47). These included wayfinding, physical comfort, social contact, and symbolic meaning. Visitors, whose presence is clearly an integral component to patient healing, are often ignored in what Carpman et al. referred

to as the "invisible visitor syndrome." These visitors purposely avoid calling attention to their own needs (such as food and nearby rest rooms) through fear that their requests might in some way diminish care provided to the patient.

Some authors claim that the need to allocate resources to improve wayfinding has evolved beyond being optional for management, especially in the case of large and complex organizations (Eubanks 1989, 25). As an example, when the newly constructed Detroit Renaissance Center shopping mall was faced with severe economic problems, a study was commissioned to find out why (Carpman et al. 1984, 9). The researchers found that spatial confusion experienced by shoppers played a significant role in poor utilization of the center by consumers.

There are numerous articles claiming success in efforts towards improved wayfinding. Unfortunately, these subjective articles lack analysis of effectiveness of implemented systems through comparison of pre-treatment to post-treatment data. In a 1982 analysis of literature on hospital design and human behavior between 1969 to 1979, Janet Reizenstein (now Carpman) criticized "fashion show" descriptive and anecdotal articles for lacking empirical research on the subject. There *have* been several prospective research efforts, though, designed to ascertain appropriate wayfinding systems for specific user behavior, facility design, and customer preference.

Carpman, Grant, and Simmons (1984) were the first researchers to bring wayfinding to hospital planners and designers. Their award winning research involved "fast track" hypothesis testing of customer perceptions *before* and *during* construction of the hospital. The results were presented to the architects and decision makers and consequently were largely incorporated into the construction. During a six year period, over 3,200 patients and visitors and 1,200 staff were involved in thirty-three separate studies. The Patient and Visitor Participation Project used interviews, surveys, observations, mockups, and simulations to determine which hypotheses were most appropriate including best distance between signs, most effective type of "you are here" maps, preferred terminology, and optimal floor and room numbering schemes (Malkin 1992,

466)(Carpman et al. 1984). While the project was successful in that most of the recommendations were implemented, there were some that were rejected. Janet Carpman emphasizes that the *political* nature of design decision making in the health profession is an important influence to be recognized. As an example, research indicated a significant preference by patients and visitors for use of layman's terminology (ear, nose, and throat) in signage rather than the confusing professional terms (otorhinolaryngology). This recommendation was discarded by physicians who were concerned about the opinions of their colleagues (Carpman 1989, 51).

Mayer Spivack (1984) is credited with developing the "Design Log" data collection approach that advocates participant observation in the design process. This method allows design to be influenced as a result of designers living in the same setting as the patient. Observations are recorded by designers in narrative form while playing the role of a patient.

Passini conducted research on how people find their way around and how they orient themselves to the environment. One of his experiments involved following subjects to a predetermined destination and recording explanations of why and where they made their decisions (Arthur and Passini 1992).

Jain Malkin (1992) developed sequential steps to development of a wayfinding system: 1) survey existing conditions, 2) interview key staff, 3) review architectural master plan, 4) review floor plans and plot destinations by volume of traffic, 5) develop design elements compatible with budget, codes, structure, and maintenance objectives, 6) coordinate with architect and engineers, 7) engage art consultant, and 8) engage graphic and signage consultant. She also admonishes that it is essential for staff to "buy into" the concept or the program will be worthless. Staff must understand how the system works, must be trained on how to give directions well, and should encounter repeated in-service training. Patients and visitors should be afforded the opportunity to receive a handout or brochure on the facility wayfinding system which can be made available at main entrances.

Several authors developed self-assessment wayfinding system checklists (Weisman 1989, 113)(Carpman 1990, 34-5), staff and patient surveys at information desks and destinations (Anonymous 1987, 12)(Anonymous 1982, 32), and formats for group problem solving (Proud 1989, 696). Others identified problem areas by following patients and visitors through the facility from entry to destination (Nowack and Middleton 1989, 12). Womack (1992, 513) and Martin (1993, 65) insist that customers must be involved as much as possible in improving a system. They suggest use of focus groups to generate ideas, develop solutions, and at the same time, build customer consensus.

Kosterman (1978, 272) suggests funneling of information on signs from general-to-specific information. In other words, destinations should be grouped under a few general headings on the first directional signs encountered by patients and visitors. Subsequent directional signs can be labeled more specifically as the users get closer to their destinations. In order to evaluate the numerous materials and methods used to develop signs, he developed a matrix whereby nineteen signage methods were compared to a set of fourteen criteria. Some of these criteria included cost, suitability for handicapped users, in-house maintenance and fabrication, durability, and resistance to vandalism. The matrix allowed the reader to assimilate a great deal of information at once, but fell short of providing a recommendation without requiring the use of subjective, "seat of the pants" estimation on the part of the reader.

Purpose

The purpose of this study is to develop, evaluate, and analyze alternative or improved wayfinding systems for Madigan Army Medical Center and recommend the most suitable system to the executive committee for possible future implementation.

CHAPTER 2

METHODS AND PROCEDURES

Robert Sommer (1969) stated "there is no single best method - questionnaire, interview, simulation, or experiment - for studying man's adaptations to his environment. One chooses methods to suit the problem and the people and not vice versa."

In this qualitative study, an assessment of the existing internal wayfinding system at Madigan was conducted based on the literature reviewed to identify shortcomings. Two articles provided self-assessment surveys (Weisman 1989, 114)(Carpman 1990, 34-5) which were collectively used to assess the efficacy of Madigan's wayfinding system. Based upon initial observations, staff comments, and the issues in the "Conditions Which Prompted the Study" section of this project, it was expected that numerous deficiencies would be identified. Efforts were made to establish why the facility's architectural planners developed the system as it is in order to develop future alternatives in concert with the overall design plan. Aspects of the specifications and designer's intent, specifically the concept design and final design as well as the design and construction criteria, were available in several volumes of "specifications" and "as built design plates" (MIL-HDBK-1191 1991; MAMC Specifications; and Architectural Plates).

In order to establish a baseline or benchmark of the current efficacy of Madigan's existing wayfinding system, two sets of surveys were administered to sample populations. There were two returns expected from this effort. First, the responses were expected to

show problematic trends and solicit comments for improvement to the existing system around which effective solutions could be developed. Second, the data from the surveys will be available for future, post-treatment studies that might be undertaken to study the effectiveness of solutions implemented as a result of this project. The two surveys, one for patients and visitors and another for staff, are found at Appendices A and B. They were revised several times based on critiques from staff members.

Patient and Visitor Survey

The patient/visitor survey was founded upon several articles and the previous surveys conducted at Madigan. Departmental lead clerks and their receptionists from sixty-four patient and visitor destinations administered and collected surveys from six customers per day for a five day week (see Table i). Medical clerks and receptionists were asked to offer half of the surveys to the first willing patients or visitors in the morning and the rest to the first willing patients/visitors in the afternoon. They were also instructed to spread the number of surveys administered over a five day period to further ensure randomness. For example, outpatient clinics were given thirty surveys of which three were administered in the morning of the first day and three were administered in the afternoon of the first day. At inpatient destinations, where first time visitor volume was expected to be low, only ten surveys were administered at random. Several administrative areas were only offered fifteen surveys for the same reason. Given the approximate one million outpatient visits per year, 1,530 completed patient and visitor surveys accounts for about eight percent of the weekly outpatient population. Of 1,530 issued surveys, 931 were returned. Fifty-six surveys were discarded for either unacceptable levels of completeness, because the respondent turned out to be a staff member, or for being

returned later than the suspense date. This left 875 surveys (N_1=875) that were coded into a database for analysis.

Table 1.--Surveys administered and returned. (See glossary for abbreviations).

	Patient/Visitor		Staff	Staff		Patient/Visitor		Staff	Staff
Survey Points	Issued	Rcvd	Issued	Rcvd	Survey Points	Issued	Rcvd	Issued	Rcvd
L&D	30	31	2	1	**MRI**	15	11	2	1
Rheumatology	30	30	4	3	**Blood Bank**	10	10	2	2
Cardiology	30	30	4	2	**8N ward**	10	10	2	2
PAD-Records	30	30	2	2	**6S ward**	10	9	2	0
Pulmonary	30	30	4	4	**7N ward**	10	9	2	1
Outpt-Radiology	30	29	4	3	**APCC**	30	9	4	3
Gastroenterology	30	29	4	3	**6N ward**	10	8	2	2
CHAMPUS	30	29	4	3	**Red Cross**	10	6	4	4
Dermatology	30	29	4	5	**7S ward**	10	5	2	2
Nephrology	30	29	4	4	**CardioThor Surg**	30	5	4	3
Nuclear Med	30	29	4	3	**JAG**	15	5	2	0
Urology	30	28	4	4	**Pharmacy**	10	4	2	0
Neurology	30	28	4	4	**Adolescent Peds**	30	2	4	3
Endocrinology	30	27	4	3	**Discharge Plan**	30	2	4	3
Opthalmology	30	27	4	3	**Patient Reps**	20	2	2	1
Orthopedics	30	27	4	3	**Inspector General**	15	0	2	1
Aller/Immunology	30	27	4	4	**Provost Marshal**	15	0	2	0
Nutrition Clinic	30	27	2	2	**Pastoral Care**	15	0	2	0
PTOT	30	25	4	4	**AMIC**	30	0	4	0
Hem/Oncology	30	23	4	4	**Patient Affairs**	30	0	2	1
LAB	30	23	4	4	**Pt Accountability**	30	0	2	1
Dental Clinic	30	22	4	3	**PAU**	30	0	2	0
ENT	30	20	4	4	**6S ward**	10	0	2	0
Plastic Surgery	30	19	4	2	**5N ward**	10	0	2	0
General Peds	30	17	4	10	**4N ward**	10	0	2	1
Well Child Peds	30	16	4	1	**4S ward**	10	0	2	0
General Surgery	30	16	4	5	**2S ward**	10	0	2	1
Rad Therapy	15	15	2	2	**OB/GYN**	30	0	4	0
Family Practice	30	14	4	4	**Pain Clinic**	30	0	4	3
Medical Benefits	15	14	2	2	**Neurosurgery**	30	0	4	1
Inpt-Radiology	15	13	2	1	**Vascular Surgery**	30	0	4	2
Infect. Disease	30	13	4	3					
ADC	30	12	4	4	**Total = 64**	**1530**	**875**	**202**	**147**

Staff Survey

The staff survey, based on a survey instrument developed for St. Mary's Hospital (Anonymous 1987, 12), was offered to 202 staff members and administered by the receptionists at the same destinations as the patient/visitor surveys (Appendix B is the staff survey). Responses were solicited from two administrative staff members and two clinical staff members at these destinations; however, several destinations were administered two surveys instead of four because of lower staffing levels, lower volumes of patient traffic, lack of clinical staff (as in a purely administrative staff section), or a combination of these reasons. One-hundred-fifty-four (154) staff surveys were returned of which seven were rejected for unacceptable levels of completion or unsolicited destinations (such as the old MAMC). The remaining surveys were also coded into a database for analysis (N_2=147). The staff surveys were primarily useful in soliciting narrative comments on potential improvements and served to validate findings of the self-assessment surveys.

Ethical Considerations

Throughout the conduct of this project, careful efforts were made to maintain a standard of ethics when handling raw data involving personal information from surveys. Uniquely individual data, such as names, addresses, job titles, and telephone numbers were specifically not collected for use in this research project to ensure the privacy of

individuals. Where respondents elected to provide private data, the information was protected and otherwise treated strictly confidentially.

Method of Evaluation

It was intended to present summarized data and trends from the surveys to the Architect-Engineer consultants mentioned in the introduction for assistance in developing courses of action. This input, an integral part of the project as suggested by the literature, was not made available. Unfortunately, when approached, the point of contact in the Seattle District Corps of Engineer revealed that the contract extension period for the consultants had lapsed. Madigan's facility managers verified this expiration. As it turned out, the consultant that was expected (but whose contract lapsed), was the same person who originally designed the system on hand at Madigan. There would have been some obvious limitations to this arrangement including potentials for her personal bias and possible defensiveness over perceived criticism of about ten years of her efforts.

As an alternate resource, the Health Facility Planning Agency (HFPA) was contacted to determine whether they had a staff member available or consultant on retainer that would be qualified to render assistance in developing wayfinding courses of action. The HFPA was not helpful in providing this assistance or in funding a consultant for this portion of the project. Curiously, while the HFPA point of contact expressed interest in the conclusions of this project (presumably for consideration by HFPA staff in future construction projects), he still maintained that the HFPA could not fund the requirement.

Womack (1992, 513), Malkin (1992, 42), and Martin (1993, 65) suggested that customers and staff be involved in the design process. Without consensus, some of the best developed plans are implemented without success and with considerable financial losses. A focus group was developed to review and possibly improve the alternatives employing nominal group technique (Veney and Kaluzny 1991, 145)(Warner and Holloway 1978, 324). The focus group was developed based on some of the same criteria used in TQM process action teams. The composition of the group included the stakeholders in the process (staff, patients/visitors, Red Cross Volunteers, Facility Engineers, etc.) and only involved interested members. The group was asked to review and rate several courses of action as well as the initial draft of criteria developed to assess the courses of action. The result of their evaluation was itself used as a variable (criterion) in the overall evaluation.

Courses of action were developed based on information in the literature review, suggestions found in the surveys, and trends and problems identified in the facility evaluation. The alternatives were then evaluated using a weighted, multi-criteria decision matrix. Varying forms of this decision methodology were used by several authors in their assessments of wayfinding systems and components (Kosterman, 1978). Essentially, criteria that are common to all alternatives were organized and weighted based on values established from the literature, survey opinion, and group consensus. Examples of criteria considered included flexibility, aesthetic appearance, cost, ease of maintainability, cost of maintenance, resistance to vandalism, durability, expandability, consistency, readability, modularity to existing signage, and compliance with regulations such as the Uniform Federal Accessibility Standards (FED-STD-795 1988). Not all criteria were included in the decision matrix. All were considered, but some were discarded if all of the courses of action were thought to have equally met the standards of the criteria in question. A common scale was established to measure each component and individual scores were

combined into a composite score (Gustafson et al. 1992, 133). Veney and Kaluzny (1991, 339) describe this as the most common approach to generating composite measures in evaluation. They annotate the basic formula, as follows, where C_i is the composite score, W_j is the weight for the jth variable, Z_{ij} the standardized score for the jth variable for alternative i, and the summation is over all m variables.

$$C_i = \sum_{j=1}^{m} (W_j Z_{ij})$$

This formula lends itself to more complex scaling systems where weights differ from variable to variable. Each wayfinding alternative was evaluated against weighted criteria in a decision matrix format to determine which was the "best alternative" recommendation.

The project, data trends and results, alternatives, method of analysis, and the best proposed recommendation is scheduled to be presented to the executive committee in a decision briefing. The executive committee is expected to render a decision to implement an alternative, request further study, or defer the decision.

Sources of Error

The four basic sources of possible research or data collection errors should be considered in any research endeavor. Respondent error, or error associated with data collected from research subjects or participants, can occur in any study that relies wholly or in part on respondent provided information. Unclear instructions to the participants or differences in individual motivation could potentially result in incorrect data collection and affect the natural results of the study. Respondent error was reduced by eliminating select

survey questions and several surveys that were obviously incorrectly completed or were inconsistently answered.

Situation error may also affect research results. Weather conditions, time of day, remote versus in-person data collection, inability to collect data in a timely manner, and other conditions may introduce undesirable error into the research process. In this project, however, the surveys were administered by receptionists who were briefed and provided written, back-up instructions.

Another important source of error in research involves error on the part of the researcher or experimenter. Researcher error can be introduced in numerous ways, but every reasonable attempt was made to eliminate possible errors. Data collection was cross-checked to eliminate transcription errors, database queries identified and filled incomplete fields, and trends were re-evaluated.

A final source of error is the instrument itself (or multiple instruments in this case). In an effort to limit the possibility of introducing instrument error in this research, surveys were developed based on proven surveys from other wayfinding studies, they were subjected to a small pilot test, and several edits were made to improve expected performance and comprehension.

Validity and reliability were attained throughout the project by following guidelines established in the literature. Assessment of the existing wayfinding system at Madigan was performed using checklists integrated from several sources in the literature. The patient/visitor and staff surveys were developed consistent with those previously used in the literature. A pilot test of each instrument was conducted prior to use. Randomness of survey recipients was achieved through measures described above. The surveys were administered by receptionists who were personally briefed on method and, as a backup measure, were given written instruction on administering the surveys. Each returned survey was personally reviewed for suitability and either rejected or loaded into a

database. While the service of the consultants was expected to provide a measure of validity based on their professional expertise, it was decided that use of concepts suggested in the literature would fill that void.

CHAPTER 3

RESULTS OF THE STUDY

Facility Self Evaluation

The first phase of data collection was a "self-evaluation" of the facility (see Appendix C). This assessment was based on a combination of two checklists found in the literature (Weisman 1989, 114)(Carpman 1990, 34-5). Individual assessments relating specifically to architectural design were not considered in the evaluation as it is not the intent of the staff to design or redesign the facility. They were considered in some cases, though, when the design shortcoming was determined to be something that could be remedied by enhanced signage or other wayfinding component. MAMC did not comply or only partially complied with the following recommendations:

- *Do architectural features, such as artwork, lighting, color, and finishes, reinforce signage in the identification of key locations?* In most cases, yes; however, there are some locations, such as medical illustrations and the medical benefits office, that lack the structural "enter here" design features that physically establish it as a patient destination.

- *Is the signage system treated as a supplemental rather than primary form of wayfinding information? Are insets provided on maps to show the relationship of the*

mapped area to the rest of the facility? No. While Madigan employs wall maps in addition to signs, the clear focus is for patients to locate destinations via the signage system. For example, in a 1.2 million square foot facility, there are only nineteen wall-mounted "you are here" maps. These maps are only found on the ground, first, and second floors (see Appendix D). They are concentrated around the Medical Mall and the sky bridges that connect the Medical Mall to the Ancillary Building (with the exception of three that are found at the Nursing Tower entrance, the main Medical Mall entrance, and the Southwest staff entrance on the first floor). The maps do not address the third floor (which houses Labor & Delivery and other post-partum / ante-partum services) or any other higher floor (see Appendix D). As can be expected, they are largely outdated as a result of several changes in department locations since the opening of Madigan. Another problem with the current mounted maps is that they are incomplete. Each map depicts only the floor on which it is located. In fact, the maps found in the Medical Mall are only partial maps showing a single floor of the Medical Mall and **only** the Medical Mall. Other parts of the facility, the Ancillary Building, and the Nursing Tower are omitted. As can be imagined, a customer on a particular floor needing assistance to a **different** floor would receive little help by consulting any nearby mounted map! Another obvious mistake is the placement of the single-floor-only map at the main entrance information desks where most new and disoriented customers will check first. If there is anywhere in the facility that needs a comprehensive map, it is at the main entrances. As it exists now, the information desks have directories adjoining these first floor maps. The directory list refers customers to other floors but, when the customer consults the map, there is only visual access to the first floor.

- *Are directories and "You Are Here" maps located in highly visible places? Are signs placed to provide maximum visual exposure, especially along travel routes?* These

two questions are grouped because neither requirement is well met. Both maps and directories are predominately mounted flush to the walls of corridors where they are not visible until a customer passes within a few feet of them. With the exception of the Medical Mall, no destination signs are perpendicular to the customer's field of view (unless they are facing the destination). The difficulty associated with this should be evident but what must also be considered is the condition of some if not many patients. Elderly, handicapped, and simply ill or injured patients may not have the fortitude to walk a lengthy hallway only to find that they are in the wrong hall when they do encounter a sign.

- *Does the wayfinding system include such components as color coding, interior and exterior landmarks. Are dominant architectural elements, such as landmarks, incorporated into maps?* No. All maps are single colored and signs are simply colored to complement the interior color scheme. Existing wall maps are merely simplified architect plan views. The literature clearly indicates that people are better able to grasp information from a "bird's eye" or three-dimensional map than from a two dimensional "plan view" map (Scurlock 1985 and Carpman, Grant, and Simmons 1986). An example of a three-dimensional map, created by graphic artists at TTSS, Inc., is found at Appendix E). While Madigan's wall maps show simplified destinations, they fail to indicate entrance points into those destinations, rest rooms, or identifiable landmark features (such as the cooling pond waterway, coffee and snack bar, piano, Nursing Tower flag pole, or even Mount Rainier).

- *Is the room numbering system consistent and is it differentiated by staff versus patient/visitor use? Does it start as close as possible to the main entry point for that floor?* Madigan employs a curious room numbering system that effectively serves the engineers (and probably the architects) but poorly serves the average user. It is based

on a grid system used for construction that is relatively useless without a grid map. (An example of a room number is G-67-05 where G indicates the ground level, 67 indicates the grid, and 05 indicates an often sequential number for a room or corridor.) The room numbers are based on a hypothetical grid and are not consecutively numbered based on a logical end point such as an entrance or corridor. Additionally, the odd sequential numbers are found at one side of the grid and even numbers are at the other side... often resulting in them being in completely different corridors. There are several examples of room numbers of adjoined offices having different grid numbers (such as 1-67-xx and 1-68-xx). As a result, the existing system is usually useful to the average user only to determine the floor level.

- *Is lighting planned to avoid glare on signs?* A notable exception to this recommendation is the directory map on the information kiosk in the Nursing Tower and, to a lesser degree, the Medical Mall information desk. Here, the overhead lights create excessive glare on the glass covering the map and directory which makes the information difficult to read.

- *Are sign locations selected so that prime sign locations are not blocked?* In most cases they are (except for the destination signs in the corridors which, as previously noted, are flush mounted and are often recessed from the corridor), especially in the Medical Mall where highly visible, perpendicular signs annotate destinations. Exceptions include the Allergy/Immunology Clinic (it's reception counter is blocked from view because it is set in to the building further than the adjacent clinic) and the Nutrition Clinic (that is also set in from the main Medical Mall, has no perpendicular sign, and is only labeled by stenciled glass on the door).

- *Do labels on maps correspond to identification signs on walls?* In most cases, yes; however some directories refer to the laboratory as "Lab," "Clinical Lab," and

"Laboratory," and the handout maps list it as "Pathology," yet its destination sign states "Clinical Laboratory."

- *Is one person in charge of managing and maintaining the facility signage system? Is there a regular review process for system validity? Is there a database with all signs, locations, and messages?* No, Madigan has been operating a decentralized system whereby any agency needing a sign change places a request to logistics. Currently, there are several locations at Madigan that are incorrectly signed as a direct result of space utilization changes. Examples include the APCC - which has no sign, the GOPC - which no longer exists, Endocrinology - where the GOPC sign remains, and numerous administrative areas that have changed and changed again without complete signage updates. For example, when PTMS was relocated from the ground floor to another location on the installation, changes were made to the door signs, but none were made to the directories on the staff elevators. Institutional standards are somewhat loose regarding creation of signs at Madigan. Examples include slow turnaround time after submission of work-orders, inconsistent use of abbreviations (e.g. CL for clinic) and capitalization (e.g. NURSING RESEARCH instead of Nursing Research), and a non-standard "ceiling-suspended" sign that was placed over a newly constructed reception window for Audiology and Speech Pathology.

- *Is the color contrast on signs sufficient (dark letters on light background or vice versa)?* This is a major discrepancy in MAMC. Numerous destination signs, in fact **most** destinations, are lettered with light colors on light backgrounds and some are difficult to read much less simply notice. Examples of white lettering on light-beige background include Anesthesia Service, Medical Library, Hematology/Oncology, Radiation Therapy, and Nuclear Medicine. Nursing Education and Staff Development

and Neonatal Intensive Care Unit are examples of destinations that use white lettering on light-yellowish background.

- *Has the facility instituted an ongoing staff-training program on how to provide directions consistently and accurately?* No, although there are already on-going and continuous staff training programs referred to as BMAR (Birth Month Annual Reviews) and NEO (New Employee Orientation), these programs do not address this subject.

While the Madigan facility did comply with a large number of these recommendations, several of the non-compliant areas are considered significant and bear special mention. Based on the results of this evaluation, the magnitude of repeated failures per category, and the importance of the recommendation as described in the literature, several non-compliant areas are categorized as having a major detrimental impact on Madigan's wayfinding system. These are, in descending order of importance, no database to track and monitor existing signage along with a single point of contact, numerous signs having poor color contrast with their background colors, inadequate design and number of wall mounted maps, and lack of perpendicular visibility for the majority of the signs.

I should make note here that during review of the criteria and specifications for Madigan's signage, it was apparent and obvious that a great deal of thought and effort went into the signage plan. The intent of this paper is not to bash the existing system at Madigan, but to improve it. Madigan is clearly the classic "complex medical facility" that is frequently discussed in the literature (see Appendix F for the currently used handout map). Any plan developed for wayfinding in a facility as large and complex as this was bound to have some shortcomings.

Patient and Visitor Surveys

The second step in gathering information to better assess the possible problems was the collection and assessment of the surveys aimed at patients/visitors and staff. The primary survey (Appendix A) was administered to patients and visitors at sixty-four destinations located throughout the facility (see Table 1 in Chapter 2).

In an effort to determine whether patients were experiencing difficulties finding their way through Madigan, respondents were asked if they needed help finding the location of their primary destination (which was also the survey site). Figure 1 demonstrates that fully sixteen percent of respondents claimed that help was needed.

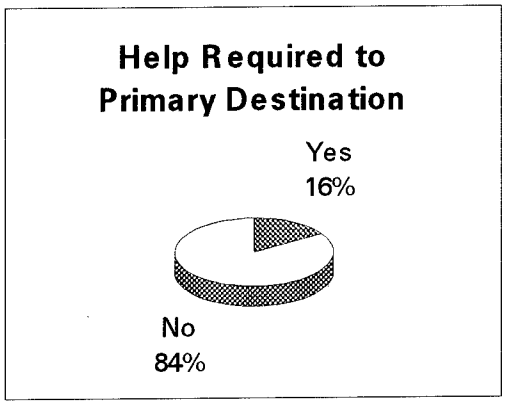


Figure 1. Help needed to primary destination.

A second database retrieval categorized respondents by frequency of previous visits to the facility. This comparison was attempted to verify that "more visits" results in fewer incidents of "help needed." The query revealed that 181 respondents were first time visitors to their primary destination (Figure 2).

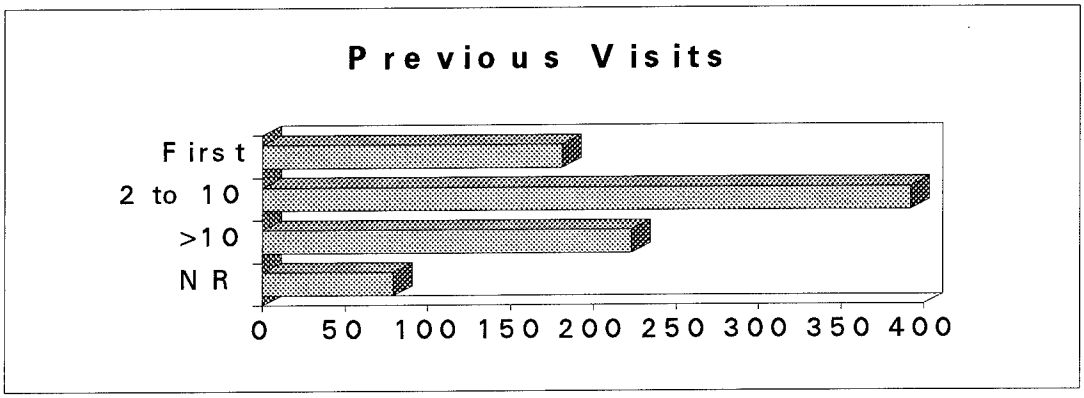


Figure 2. Previous visits by respondents (NR = no response).

First time visitor responses (181 shown in Figure 2) were then compared to incidents of whether help was needed. It was found that of 142 respondents (16 percent of total 875 respondents; Figure 1) needing help to find their primary destination, sixty-four (45 percent), were first time visitors, fifty-eight (41 percent) had been to Madigan two to ten times previously, and nine (6 percent), had been there greater than ten times before. (Eleven of these respondents failed to indicate the number of previous visits to Madigan.) While it was expected that there would be an inverse relationship between "help needed" and "number of visits", the number of respondents still needing help after two to ten visits is surprisingly high. This suggests that there is, in fact, a wayfinding problem at Madigan that should probably not be explained away as "they'll be able to find their way after a few visits."

The survey then asked whether respondents experienced *difficulty* in finding their way to their primary destination. It was hoped that this question would help to quantify

the *level* of difficulty encountered. Only seventy of the 142 respondents who needed help finding their way further expressed that it was *difficult* to do so. Figures 3 and 4 show these responses.

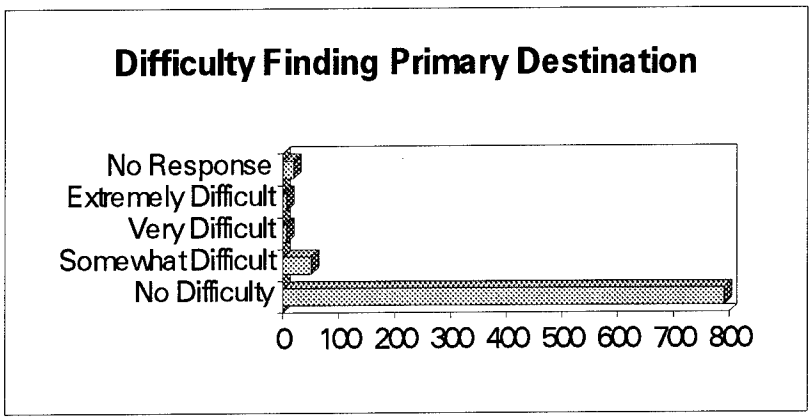


Figure 3. Wayfinding difficulty levels.

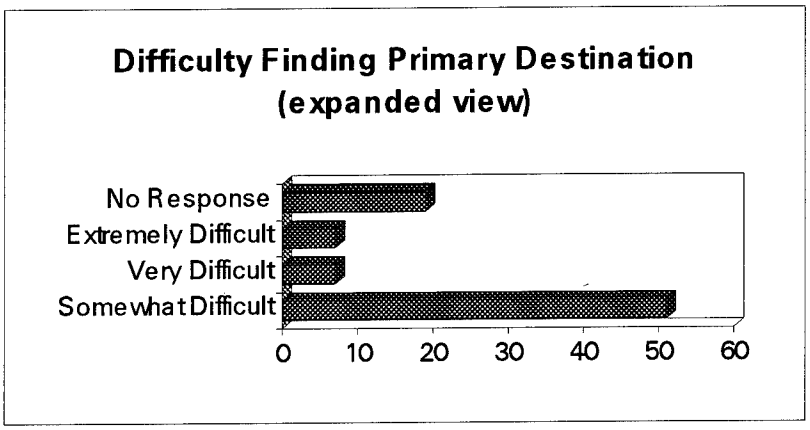


Figure 4. Wayfinding difficulty levels (expanded view).

In order to solicit feedback on why respondents were experiencing difficulties, they were asked to mark one or more of ten reasons on their surveys to which they attributed their difficulties. These factors, extracted from the literature review, are illustrated in Figure 5.

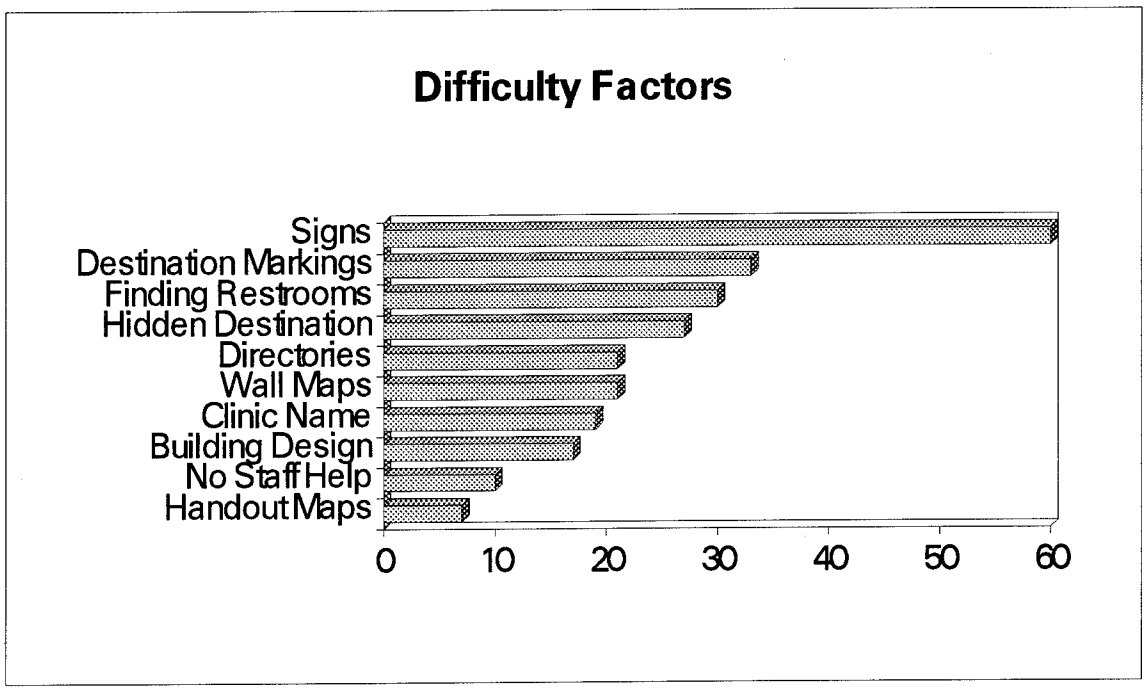


Figure 5. Reasons for wayfinding difficulties.

The difficulties encountered by respondents match, for the most part, those identified in the facility self assessment and found in the "Conditions Which Prompted the Study." Recommended solutions to these problems are found in Chapter 5.

The survey design next attempted to determine *which* areas in the facility were most difficult to find. Since the sample size, by destination, was too small to adequately find significant trends of "help needed" by location (percent values, by destination, that accounted for total "help needed" ranged from 0.00 to 7.04 percent), facility destinations

were compared to the facility map and grouped. Several groupings, from general to specific, were made. It should be understood that these comparisons are extremely general in nature because they are biased by the disparity in numbers of surveys offered at each location. For example, thirty surveys were offered to Cardiology while only ten were offered to floor 8N. By design, there were fewer overall surveys offered to the Nursing Tower than to the Medical Mall.

The most general, a grouping of respondent's destinations by whether they were in the Medical Mall, Ancillary Building, or Nursing Tower, was compared to whether help was needed. These three general groupings were selected based on the major components of the facility design (see Appendix G). Discounting the bias mentioned above, Figure 6 shows that of 142 respondents who needed help finding their way to primary destinations, thirty percent experienced difficulty in the Nursing Tower, fifty-six percent in the Medical Mall, and thirteen percent in the Ancillary Building. The survey asked respondents whether they experienced difficulty finding other locations (besides their primary destinations) in Madigan as well. These other locations naturally include areas not listed in the primary destinations such as the "PX area" or concessions area on the ground floor.

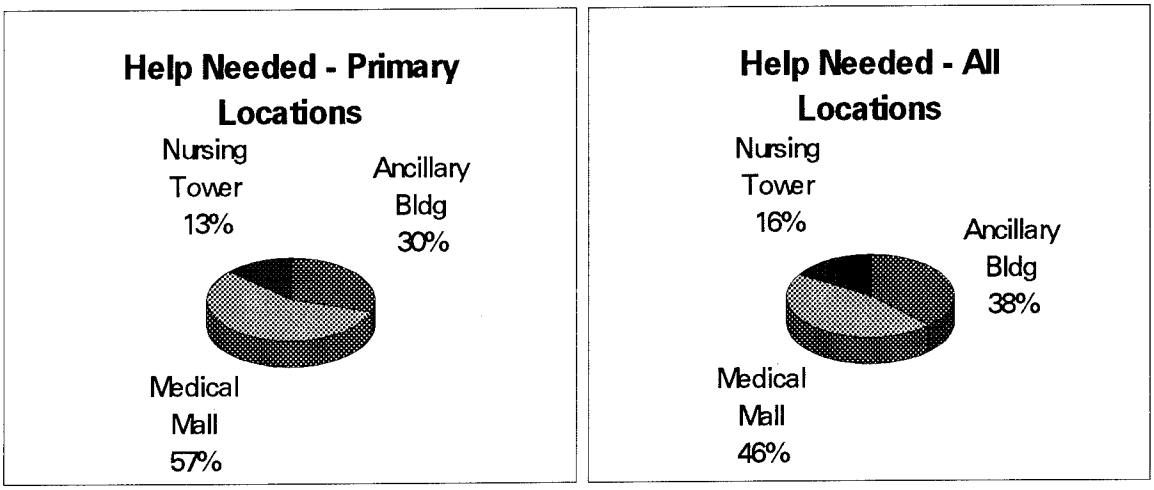


Figure 6. Difficulties by grouped areas.

By adding these positive responses to the first pie chart in Figure 6, a second pie chart was developed showing 263 total respondents who expressed difficulty encountered in finding their way to any destination. Similar ratios were found to exist between both charts.

By expanding the question from "help needed to primary destination" to "help needed to any destination", the positive responses jumped from sixteen percent of total respondents to **thirty** percent, respectively. The three general areas were then grouped more specifically by major building design component and by floor level. Resultant group categories were the Medical Mall Ground Floor, First Floor, and Second Floor; Ancillary Building Ground Floor, First Floor, Second Floor, and Third Floor; and Nursing Tower Ground Floor, First Floor, Second Floor, Third Floor, and Fourth Floor and above (MM-G, MM-1, MM-2; ANC-G, ANC-1, ANC-2, ANC-3; and NT-G, NT-1, NT-2, NT-3, NT-4+). It was found that the four specific groupings that were most highly associated with wayfinding difficulty were MM-G (24 percent), ANC-1 (15 percent), ANC-G (14 percent), and MM-1 (13 percent). These rankings can be explained, in part, by the higher number of visitors to these areas (Family Practice, OB/GYN, and Internal Medicine), by the higher number of surveys provided in these areas, *and* by difficulty in wayfinding. As an example, the self survey of the facility indicated that certain areas are poorly signed. Some of these same areas, such as the PX area, Radiology, Allergy/Immunology, CHAMPUS, Gastroenterology, Laboratory, and Urology, have the highest survey incidence of "help needed."

Perhaps a more valid assessment of determining which destinations are most difficult to find is to compare incidents of "help needed" by destination instead of by total incidents encountered. Table 2 shows the seventeen locations where more than twenty percent of respondents *per destination* indicated that they needed help. Again, some of the same destinations that were identified as deficient in the facility self assessment are found in this table (the Ante-natal Diagnostic Center, surgery clinics, CHAMPUS, Discharge Planning, Gastroenterology, MRI, Medical Benefits, and Urology).

Table 2.--"Help needed" by destination.

Location	Percent	Location	Percent
Patient Reps	100.00	**Gastroenterology**	27.60
CardioThor Surg	80.00	**Allergy/Immunology**	25.90
MRI	63.60	**General Surgery**	25.00
6N ward	62.50	**PAD-Records**	23.30
Discharge Planning	50.00	**Urology**	21.40
ADC	50.00	**Nutrition Clinic**	22.20
Medical Benefits	42.90	**Dermatology**	20.70
CHAMPUS	34.50	**Blood Bank**	20.00
8N ward	30.00	Total=17	

While most areas in the facility that are associated with difficulties are in the Medical Mall and Ancillary Building, it should be recognized that a sizable number of customers use the Nursing Tower entrance (see Figure 7). This information must be

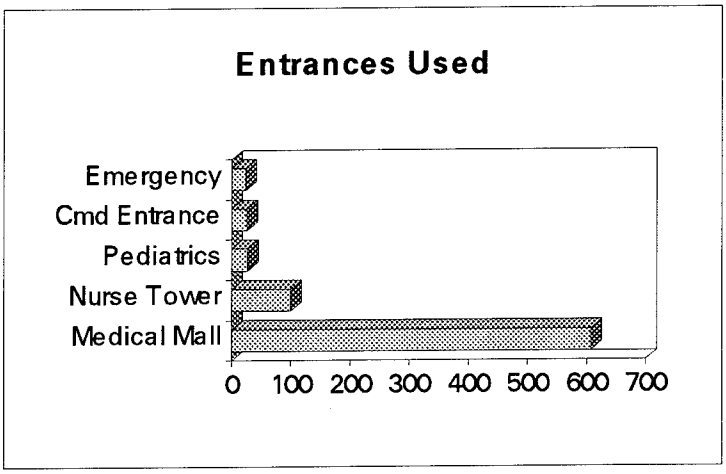


Figure 7. Entrances used.

considered when developing and applying solutions to wayfinding problems. For example, corrections should not be solely focused on the Medical Mall because of the large number of people who use the Nursing Tower entrance to access more that just Nursing Tower destinations.

As the Executive Committee deliberates over the issue of improving wayfinding they will certainly reflect on how important they consider wayfinding to be. To assist them, the survey asked respondents to rate how important wayfinding was to them.

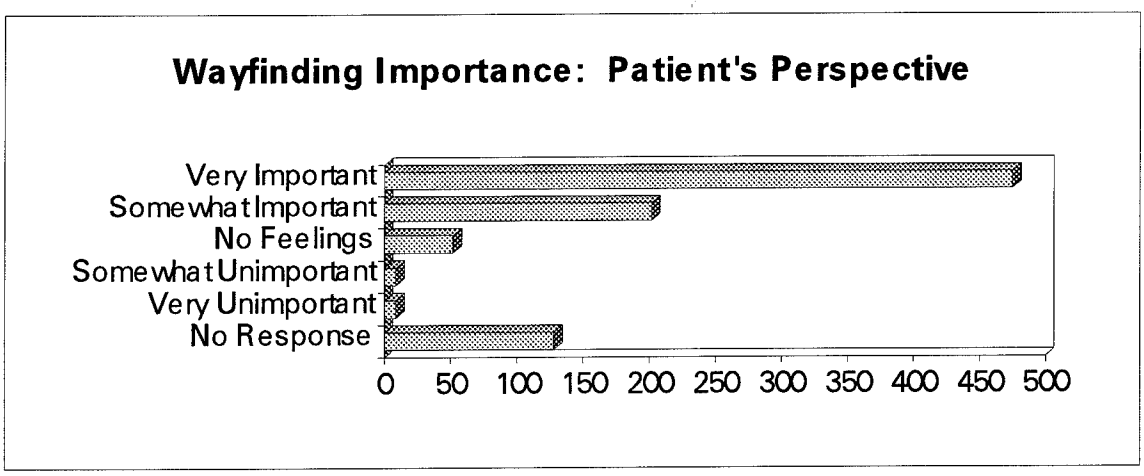


Figure 8. Wayfinding importance: Patient's perspective.

The graph in Figure 8 illustrates that a large majority of respondents find wayfinding to be *very* important.

On the other hand, responses were overwhelmingly negative to the question "If you could go to a local civilian facility at no extra cost or a small cost, would you go there **because of any difficulty** you have experienced at Madigan **in finding your way?"** (Figure 9). This suggests that while wayfinding is highly important to customers, it is not

worth as much to them as it is *valued.* To the manager, this might indicate that resources spent to improve wayfinding would be spent for reasons beyond cost effectiveness.

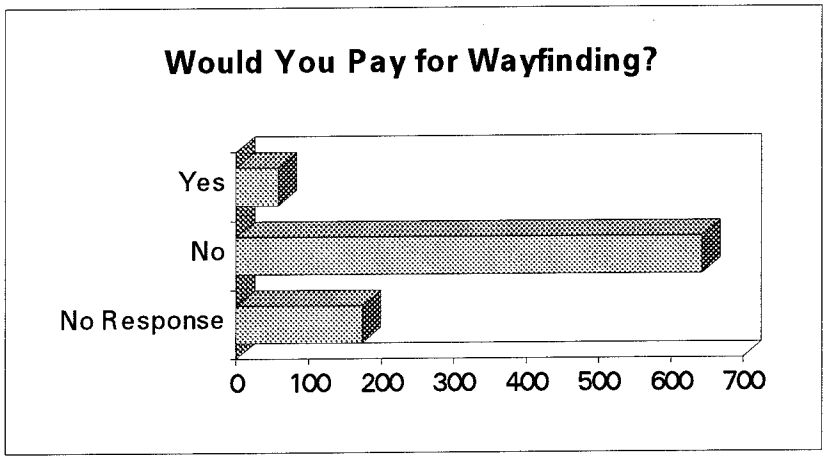


Figure 9. Wayfinding worth: Patient's perspective.

As a measure to assist in developing titles of future clinics, a preference comparison of layman's terminology versus clinical terms was offered in the survey. The results, shown in Figure 10, indicate a strong preference for layman's terms by the respondents (only respondents who properly answered all four questions were considered). This preference is consistent with the literature.

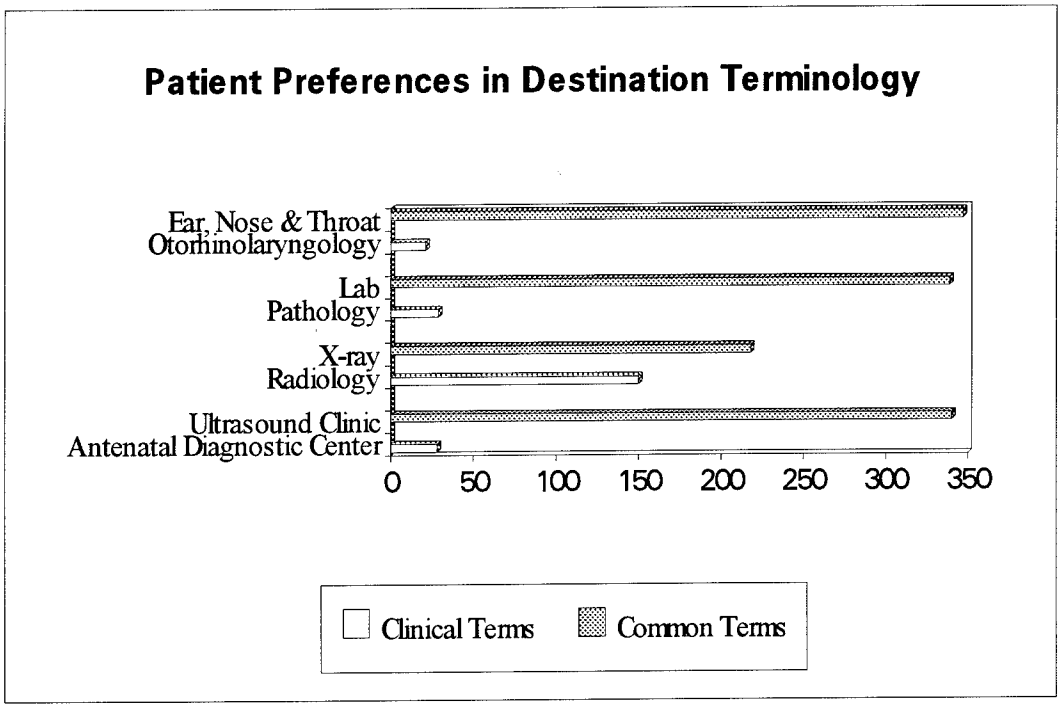


Figure 10. Patient preference in terminology.

Staff Surveys

The staff surveys (Appendix B) were administered to staff members as described in Chapter 2 and Table 1 at the same destinations as the patient/visitor surveys. Results from these survey responses were quite different in some areas than the results from the patient/visitor surveys. For example, while only sixteen percent of the patient/visitor respondents expressed difficulty in finding their primary destination, and thirty percent expressed difficulty finding other locations, fully **seventy-eight** percent of the staff respondents indicated their customers had difficulties finding their location. Additionally, more than forty-six percent of the staff responded that patients and visitors wandered into their location to ask directions. This difference between responses from the staff and the patients/visitors may be an issue of perception on the part of respondents on what the term

"difficulty" means. For management's assessment of the issue, it should be safe to assume that the actual volume of patients/visitors experiencing difficulties lies somewhere between these percentage values.

Several authors in the literature suggested that significant cost savings could be realized if wayfinding was improved. One component of savings associated with wayfinding is the reduction of staff time spent in the provision of direction assistance. While it can be argued that there is a certain benefit gained in customer relations if a staff pleasantly and efficiently interacts with customers, there are still negative opportunity costs involved if the staff is questioned too frequently. The survey asked respondents to estimate the number of times they were asked directional questions per day. Figure 11 shows that sixty-one percent of respondents were asked questions at least one to five times per day. In comparison to the Canadian hospital mentioned in Chapter 1, Madigan's wayfinding problem is apparently larger (Weisman 1989, 113).

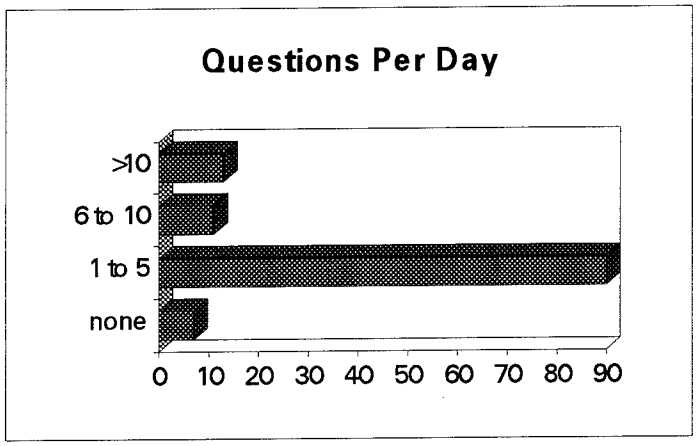


Figure 11. Directional questions to the staff.

Another surprising result of the survey showed that over thirty percent of the staff respondents admitted to personally getting lost at Madigan. Of the forty-five members who indicated they get lost, forty of them have been employed at the new facility for greater than six months. Seventeen members indicated they had difficulties finding their way to destinations on the Ground Level and three had difficulties around the PX area, also on the Ground Level.

The staff survey questions were largely designed to solicit narrative responses. The intent was to garner input from experienced staff on how to potentially improve wayfinding from their perspective. Suggestions were varied and interesting, but were, for the most part, similar to suggestions found in the literature. Some suggested colored lines or tiles on the floors to prominent locations, installation of electronic touch-screen locators, hand-out maps, more signs, increased staffing of the information booths (one physician recommended having the administrative staff wear sandwich boards offering help), and many suggested leaving the whole issue alone. All of these suggestions, with the exception of the sandwich boards, were considered.

Courses of Action

Six courses of action and a combination alternative were developed based on the literature review, advertisements offered for wayfinding, solicitation from the Society for Environmental Graphic Design, the surveys, and discussion with staff members. The courses of action are:

1. Electronic system
2. Re-sign the facility
3. Street signs with handout maps
4. Colored floor lines to primary destinations

5. Fix identified existing errors

6. Do nothing

7. Combination of above

The electronic system alternative is available from at least two firms. DynaTouch Inc. and TTSS Inc. were contacted and both sent brochures on their products. Both use touch-screen monitors that are connected to either stand-alone computers or are connected through the existing LAN network to a central computer. They are loaded with directories of locations and maps of the facility and are housed in either attractive kiosks or can be set up similar to a personal computer at an information center. They can be configured to offer a three-dimensional multi-media display, animation, voice, live video, and more. Some are configured with printers that will print a map to a requested location and can be loaded in multiple languages. Depending on the model, some can be changed with information updates at a single central location instead of at each terminal location. There are several options that are nice to have, but are certainly not a necessary ingredient to improving wayfinding. Examples are the survey option, current activity listings, directories, hours of operation, and the patient location option where inpatient's names and room numbers can be found. The survey option allows locally developed surveys to be loaded and administered at each terminal station. TTSS provided a demonstration disk that is available for review by the focus group and the executive committee.

TTSS outfitted several institutions with, for example, four terminals at the Mayo Medical Clinic, four at the entrance of the Los Angeles Public Library, twenty at the NASA headquarters building, and seven at the AMOCO headquarters building. While it can be assumed that Madigan would need approximately the same number of stations as other large facilities, a rough price summary was solicited from one of the vendors for a simple two station system (one at each of the main entrances). The price of $29,285 included monitors, processors, kiosks, printers, software, graphical presentation development, software edit license, on-site setup and training, and shipping. It did not

include fees for additional training, service contracts, changes to graphical presentations, or software upgrades. As evidenced by the survey data, Madigan would need more than two stations. Another consideration for this type of system is the ability for it to service several customers at a time. A single station can serve only one person at a time and might cause queuing problems where other wayfinding systems might not.

The second course of action, re-signing the entire facility, would be an effective, but quite expensive option. A signage firm could re-design the signs, directories, and maps so that they matched the existing color scheme and design intent. They could hang the signs so that they were visible to the customer's line of sight (perpendicular) and could offer appropriate color contrast from the sign's background. The system could be similar to the system employed at the University of Washington Medical Center or one of many airport systems. Color could be used to differentiate between floors, components of the building, or even primary destinations (such as is found at the University of Washington). The new signs would/could replace the directional arrow signs currently flush mounted to the walls at Madigan.

Both the wall mounted and handout maps currently employed by Madigan should also be re-designed. As discussed earlier, they are difficult to read, incomplete, and, in many cases, out-dated. Both should be full-facility, three-dimensional maps that provide a birds-eye instead of plan view. They should incorporate landmarks for orientation such as the cooling pond, the piano, snack bar, escalators, flagpole, etc. There should also be more wall mounted maps throughout the facility, particularly in the Ancillary Building, logistics area, PX area, and adjacent to all vertical travel areas such as elevators.

A third option, adding street signs to the existing Madigan system along with improved handout maps, offers some interesting benefits. In addition to this option not projected to be extremely expensive, it also has some versatility to it. One thing about Madigan, and probably all medical facilities, is that it faces continuous space resource changes. In the eight months involved with this project, numerous office and clinic

changes have occurred. The signage has barely kept up with the changes and in many cases has fallen way behind. If attractive and prominently displayed street signs were attached to all corridors in the facility, and attractive, well planned handout maps were available at all entrances, any number of future changes could be easily and inexpensively made. The signs could be made of colors that complimented the existing facility design and could be mounted in such a way that would even offer perpendicular visibility to the elderly and impaired, who often experience difficulties with fields of view. Color or a numbering system (or both) on the signs could be used to differentiate between floors. Customers should find the system easy to use as it is a familiar and common system widely used throughout our society. For the same reasons, staff could be easily trained in giving directions, particularly if the selection of street names was associated with local landmarks (Rainier St., Olympic St., Chapel St., etc.). The cost of producing handout maps could be partially recaptured by placing collection bins at exits. Added value to the maps could be realized if they were used as condensed patient handbooks providing hours of operation, service changes, and other pertinent information.

A fourth alternative is to use colored lines on the floors to high volume destinations such as the lab, pharmacy, and radiology. This alternative is attractive in that it has been tested and found to be effective at many locations. It also addresses the "80-20 principle" of fixing the high volume problem areas first. A problem associated with this system is that it is not a stand-alone system. Staff members must be available to tell customers which color to follow to get to their destination. It also fails to address the customers who might not be looking for the colored locations. Another issue associated with cost is the expense of maintaining and installing colored tiles in the linoleum and (worse yet) the clay tiles of the Nursing Tower entrance and Medical Mall.

The fifth option was to salvage the existing system through "fixes" of identified errors. The majority of the needed corrections were identified in the facility self assessment phase of this project. This option has already been started by the facility

engineers to a small degree who added signs mounted perpendicular to the wall to indicate locations of public telephones. By extension, mid-sized signs could be designed with attractive symbols that would compliment the existing system yet still attract customers to the information provided by the current system. For example, signs with the international "question mark" indicating "information" could be placed above facility maps and directories. Other signs could be placed to indicate male/female rest rooms, stairwells, etc. While this method would not in itself offer complete perpendicular visibility to the customer, it would at least show them where destination and locators are from a distance. Madigan's destination signs that have low contrasting colors could be changed relatively easily and other problems, such as the lack of highly visible signs at the Nutrition Clinic could be corrected similarly.

The wall mounted "you are here" maps should also be revised, as discussed in course of action 2, the re-signing alternative. The handout maps should also be of a higher quality design than those currently in use and should match the wall maps. Attractive pamphlets could be designed and available at entrances, a portion of which could be collected at exit bins as mentioned above for re-use.

Room numbers should be re-labeled in all areas, not just the wards. The current system can be maintained for use by the engineers as they implement work orders and a more "user friendly" system could be installed at the top center of doorjambs to complement their system.

An essential component to this plan involves the commitment to select a single manager for the wayfinding system. This person should track changes and conduct periodic inspections of the system. The best method would be for them to create a database to track the information in all directories, signage, and messages, by location, in the facility. When changes to the facility are implemented and new signs are needed, the database would enable the user to find out where all changes should be made. This would eliminate the random skipping of necessary changes that has been occurring at Madigan.

A designated person would also serve to ensure a more rapid turn-around for requested signs and could provide much needed stability to ensure that pre-determined standards for sign content and design are maintained.

The "Do nothing" option must also be considered. There were quite a few responses from both surveys that stated preference for or otherwise indicated no need for change. Besides being the least expensive option (for the short term), it can be argued from the data that there is no urgent need to change the system. In fact, there is no data that suggests that anyone has not ultimately been able to get to their destination. This "bottom line" must, however, be balanced against what is the right thing to do regardless of cost, what is best for the customer, and what might happen as a result of *inaction* when Madigan moves into a more competitive market situation as a result of TRICARE's triple options.

The last alternative, although not included in the decision matrix, is to implement a combination of the above alternatives. This option is suggested in addition to the "best" alternative because it will allow cross-leveling of some of the best features of each alternative. It was not considered as an alternative by itself because of the probability that it would skew the decision matrix results by removing any distinction between it and other alternatives.

Decision Matrix Criteria and Weights

The criteria or variables by which each course of action was compared were primarily developed from suggestions in the literature. Some were tailored to address specific strengths and weaknesses that a particular course of action had to offer. This was done to allow the alternative to be "benchmarked" against the other alternatives where it would not have been able to be compared otherwise. Weights assigned to the various

criteria were developed based on concepts and priorities in the literature, facility design intent, knowledge of the senior staff philosophies, status of current and expected fiscal priorities, staff discussion, and input from the facility engineers. Criteria were assigned weight values between one and seven where seven is more desirable than one. An example of weight assignment is cost, where high cost is undesirable, and was consequently weighted with a value of one. Ease of use, on the other hand, was considered to be very desirable and was weighted with a value of seven.

The first criterion in the decision matrix addresses the preference of facility customers for *their* choice of the available alternatives. Several customers and staff were asked to consider all of the criteria, review the courses of action, provide comments about the criteria and courses of action, and select their choice of the "best" alternative based on their knowledge of the facility and the information provided. Their input was used to hone the criteria and assist in the weighting of the variables. The group consisted of staff members, patients, a Red Cross Volunteer, and a facility engineer. The group's input was then ranked and became a variable itself titled **"focus group rating."**

The second criterion, **"mutually reinforcing elements,"** is intended to evaluate the ability for an alternative to be used in tandem with other components of the entire wayfinding system. The literature states that different people use different degrees of different cues, so it is considered desirable to have multiple cues in a system. For example, the option to use street signs with maps allows different users to use a handout map, the street signs, and the existing directories and destination markings in whatever degree the user personally prefers. An option that has several mutually reinforcing elements that all "point the way" is better than one that is self-reliant such as the electronic wayfinding option.

"Modularity to existing system" is a criterion used to compare alternatives on their ability to be able to build on the existing system. This alternative was determined to be important from a cost standpoint as well as the aesthetic standpoint of need to match

the current architectural and graphic designs. The intent is to avoid replacement or removal of the existing system and to be able to gracefully compliment and salvage use of the components already on hand.

Similar to the above criterion is the variable **"current design compatibility."** This was used to judge whether the proposed system would conflict or had the potential to conflict with the architectural design, artwork and graphics, or planned color scheme. The literature suggests avoiding heavy use of color for directions when color is an integral part of the facility decorative package. Similarly, any option that would change the appearance of the facility design, such as large hanging signs, would also be rated low.

"Installation disruption" was also selected to evaluate the unwanted potential of an option to create significant or extended blockage or other disruption as a result of installation. Completely re-signing the facility and replacing floor tiles with colored tiles were estimated to have the potential to cause high disruption due to installation.

"Durability" was considered to be an important variable. It had significant mention in the literature and warrants review simply because of the increasing cost of vandalism. The electronic option was rated medium because it is a "touchable" system with electrical computer components. The colored floor line option was also rated low because of the nature of floor tile and the potential to use painted lines instead of a more durable material.

"Ease of maintenance" was a similar criterion to durability, but differed in that it focused on how *easy* it would be to repair the system once damaged instead of how well it would stand up to wear and tear. The electronic system and colored lines were rated lower than the rest of the options.

Certain systems were thought to be easier for the average customer to use on a first time basis than others. **"Ease of use"** addressed this issue in the decision matrix. The electronic system has a learning curve associated with it, as do colored lines on the floor. The colored lines are only useful for certain, high-traffic areas. They were not

considered easy to use unless you happened to be located where lines are painted *and* are near a staff member to tell you which line to follow. The "do nothing" option was also rated low compared to this criterion.

The ability for the system to be expandable was also a requisite feature. Considering the new addition that is in the process of being built and the strong potential for future facility expansions (space is always at a premium in this facility), the wayfinding system must be easily and inexpensively expandable. The electronic system, with its program to change and add computer designed maps, was rated high in **"expandability"** while the "re-sign" and "colored line" options were rated low.

A similar variable, **"flexible to change,"** refers to the ability for a system to easily adapt to minor facility changes such as a clinic re-location, movement of offices, etc. This phenomenon, very common at Madigan and other medical institutions, was weighted quite high accordingly. It was thought that the electronic system, in particular, and those systems reliant on maps, to a lesser degree, were the best suited to easily handle this type of change.

A perceived shortcoming in the electronic system prompted addition of **"accessibility to users"** as a criterion. The electronic system is only capable of directing one person at a time while other systems, such as overhead signs, can be used by many customers simultaneously. The queuing problems inherent to electronic systems could obviously be remedied through purchase of several terminals to be located nearby each other, however this solution might be cost prohibitive.

In an effort to specifically address one of the biggest shortcomings in Madigan's existing wayfinding system, the criterion **"perpendicular visibility"** was developed. As discussed earlier, customers must be able to see signs far enough in advance of a decision point for the sign to be effective. Madigan, with few signs or directories perpendicular to the customer's view, needs some perpendicular visibility in its system to be effective. The "electronic system," "colored lines," and "do nothing" alternatives were rated low; "street

signs" and "fix existing errors" were rated medium; and "re-signing the facility" was rated high.

A flaw in the "colored lines" alternative was addressed through a criterion called **"stand alone ability."** The drawback to this option is that a staff member *has* to be available to direct customers to the correct line. The system does not "stand alone" in that customers are generally not able to use it without assistance.

A criterion labeled **"space requirement"** addressed whether alternatives needed to occupy any floor space. This aspect was negatively rated because floor space is a commodity not easily re-gained and existing space is well balanced in the architectural design. Addition of one or more kiosks, such as might be required by the electronic system could take up already limited amounts of space and might alter the current balance of open space in the facility.

The variables **"cost-purchase," "cost-consumables,"** and **"cost-contract"** were all weighted low (highly negative) for obvious reasons. Some options had no potential for contract or consumable costs and were rated neutral. High purchase cost and requirement for contract maintenance were considered extremely negatively and were rated accordingly.

"Appearance" was also considered and weighted fairly heavily. It was thought that a facility as new and pleasingly designed as Madigan warranted consideration given to attractiveness instead of mere functionality.

The final criterion, **"gadgetry,"** was developed to assess the courses of action having options that provided added value. They were ranked "yes" or "no" depending on whether they had extra options or not. The only course of action that had extra options was the electronic system with its surveys, voice feature, print-out maps, animation, etc.

Decision Matrix

As described in Chapter 2, the six courses of action and nineteen criteria were then loaded into a decision matrix for calculation (see Appendix H). The criteria were assigned a seven point weight which was converted to ratings of negative three (-3) to positive three (+3). These new ratings were totaled and divided into one hundred to develop the scale factor. The scale factor was then multiplied by the coded rating to provide the re-scaled rating.

Depending on the degree that each course of action complied or failed to comply with the specification of the criterion, that value was converted into a percentage of the total value attributable to the criterion and consequently was apportioned only that percentage of the re-scaled rating amount. For example, if only one course of action was considered to possess the attributes of a criterion, then it was apportioned the full value of the re-scaled rating (100 percent) and the other five courses of action received none of the rating. If three of the alternatives possessed attributes, they each received thirty-three percent of the rating and the other three options received none.

Each course of action was compared to each other and to each criterion as described above. The total of their portions of the re-scaled ratings (% W_j) was calculated to develop C_i, the relative rankings of each course of action. These rankings were either positive or negative values; of course the largest positive value was the "best alternative" to be recommended to the executive committee.

CHAPTER 4

DISCUSSION

The results of the decision matrix were relatively consistent with what was expected. The C_i values indicated that, based on the criteria assessments, the "fix existing errors" alternative was the best, followed closely by the "street signs with handout maps" alternative. The values were **25.82** and **24.24** respectively. Re-signing the facility received a rating of **19.71,** "do nothing" received a **17.71**, and "colored floor lines" received a **12.94.** The lowest value was for the "electronic system" alternative which received a rating of **-0.65** (Appendix H).

As mentioned earlier, the alternative selected should be implemented with serious consideration given to the addition of some of the best components of other alternatives. The "fix existing errors" option does not perfectly address the issue of perpendicular visibility. As coordination is made with a sign fabrication company to develop corrections, they should be consulted for options on how to drop destination signs in the hallway as opposed to keeping the destination signs flush with the entrances as they are now. A high quality handout map, designed to be attractive and informative, should also be developed by a firm with artistic design capability. This component should almost be an understood requirement for any wayfinding system. While Madigan has handout maps now, they are photocopied, two dimensional, and somewhat difficult to read (Appendix F).

Identification by management of a single manager of the wayfinding system, along with a database designed to track the details of the system components, is also an integral part of the alternative that cannot be overlooked. Responsiveness to directed change is

important. A few signs to reflect operational changes in the facility should be an easy task to have performed and it certainly should not be one that is embroiled in bureaucracy.

There are a few limitations associated with this project that bear mentioning. The magnitude of the pilot test of the survey instruments was, in retrospect, less than optimum. It should have been tested on a more substantial number of respondents to identify problems with comprehension of questions. As an example, few respondents actually understood how to answer the survey question regarding preference of terminology. For this question, many checked more than one choice per destination name and others checked only one box to indicate their preference for the entire column of choices. A larger pilot would have shown this trend and the directions to the question could have been refined. Instead, most responses were incomplete and had to be culled.

There should have been more forethought on how the survey was to be coded into the database. As an example, the survey asked respondents how many times they had been to Madigan before. Once the surveys were received, the responses were coded by grouped ranges (first visit, two to ten visits, and greater than ten visits). These groupings of visits should have been developed into the survey up front. Other omissions made coding of the data into the database more difficult than should have been necessary.

The limitation associated with the unavailability of a consultant has been discussed in preceding chapters. This failed resource was unavoidable. Attempts were made to find a different source for the consultant service, but were unsuccessful. It cannot be estimated how valuable a consultant's services would have been (or *not* have been).

Perhaps the most significant limitation to the data was the secondary error in selecting the sample size. While the sample was appropriate for the entire number of customer visits, there was a relatively low sample size per destination. This method met the intent to look at general trends, but it limited the ability to accurately assess the significance of wayfinding problem per specific facility area.

Another limitation to the study inherently exists in the use of a weighted, multi-criteria decision matrix. There is a degree of subjectivity involved in selection of criteria to be assessed, their respective weights, and the degree of compliance attributed to each course of action per criterion. Because this limitation is inherent to any weighted decision matrix model, special effort was taken to eliminate personal bias in coding of the weights and ratings. The focus group review is expected to have pointed out glaring errors for remedy. Use of their preference rating as a criterion was also intended to smooth out some of the bias, if present. Several reviews of the decision matrix were made by the researcher and select staff. The personal reviews were separated by significant periods of time to allow a relatively fresh view each time for objectivity. Ratings that were considered to be potentially questionable were changed and run through the decision matrix separately. The same "best alternative" was identified, although with slightly smaller variances between alternative ratings.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The best recommendation to the executive committee on how to improve wayfinding at Madigan Army Medical Center for patients, their visitors and companions, the staff, and vendors is to implement the "fix existing errors" alternative. In Chapter 4, the decision matrix was discussed and this alternative received the highest score from that decision tool.

This option is based on the intent to salvage the existing system through "fixes" of identified errors. The errors needing corrections were primarily identified in a facility self assessment that was structured from a checklist found in the literature. Attractive signs should be designed, developed, and then mounted in such a way that they can be seen from down the hall. Signs identifying the location of information, such as signs depicting a "question mark," could be placed above and perpendicular to the existing flush mounted directories. Other signs indicating male/female rest rooms, fire extinguishers, stairwells, water fountains, etc. should also be placed in appropriate locations that can be seen from a distance.

All of the destination signs that have low contrasting colors must be changed. Either the facility engineers can do this on their own, depending on the material currently used, or a sign fabrication company can be hired. Other signage problems, such as the lack of highly visible signs at the Nutrition Clinic, should be corrected through installation of the same type of stand-out sign used on the rest of the Medical Mall clinics, or some

other high contrast sign. Other signs, such as the difference between the Dermatology/Rheumatology/Endocrinology stand-out sign and the reception flush mounted sign (marked as Dermatology only) should also be corrected. Another example is the stand-out sign titled GI/Allergy/Immunology. This sign draws patients to the GI reception desk where there are several paper signs directing the Allergy/Immunology patients further down the mall to the (hidden) reception desk they need. There are numerous corrections required, and these are simply a few mentioned for illustration.

Both the wall mounted and handout maps currently employed by Madigan should be re-designed into full-facility, three-dimensional maps that provide a birds-eye instead of plan view (see Appendix E). They should incorporate natural facility landmarks for orientation such as the cooling pond, the MRI building (a destination not on current maps), the piano, snack bar, escalators, flagpole, etc. The maps should also indicate the locations of clinic entrances. This is not the case with the current wall maps. There is also a need for more wall mounted maps throughout the facility, particularly in the Ancillary Building, logistics area, PX area, and adjacent to all vertical travel areas such as elevators.

Current directories with arrows should be standardized. Each destination on each directory should have a dedicated directional arrow. The current system has a left pointing arrow at the top of the directory, followed in column by those destinations, followed by a right pointing arrow, followed by destinations to the right. Most directories shown in the literature use a left or right pointing arrow adjacent to each destination to avoid confusion. Some confusion exists with the current system when customers look at a destination immediately above or below the right pointing arrow.

There are several destinations that have confusing titles. Examples include the staff office areas near the command suite that are titled "Administration" which often attracts customers who are seeking the "Patient Administration" offices. The Laboratory is titled "Laboratory", Clinical Laboratory", and "Pathology" on various wayfinding aids. Both the ground and second floors in the Medical Mall have staff office areas with the

same titles of "Administration." There are numerous outdated, incorrectly abbreviated, and incorrectly capitalized destinations found in the directories throughout the facility. There are even omissions, such as no listings for the Provost Marshal's office, the medical benefits office, and the surgery waiting room for family members. These errors and other similar errors should be evaluated, preferably as a result of a database review, and corrected. Additionally, the glass in the main directory of the Nursing Tower in particular, and that in the Medical Mall secondarily, should be changed to "non-glare" glass.

Room numbers should be re-labeled while retaining the current system for use by the engineers as they implement work orders. A "user friendly" room numbering system can be installed adjacent to the current numbers at the top center of doorjambs. See previous chapters for a more detailed discussion of this issue.

An essential component to this plan involves the commitment to select a single person to manage the wayfinding system. This person must track changes and conduct periodic inspections of the system. They should create a database to track all directories, signage, and messages, by location. This database would, if developed, show outdated destinations such as markings for the PTMS office that has been relocated from this facility for almost a year. A designated person, from whichever office selected, must be directed to develop a responsive sign creation program that keeps up with current changes. In fact, there should be a policy developed to ensure that no changes in space or space names should be made without wayfinding staff member input.

The results of this project are scheduled to be presented to the executive committee for discussion and implementation.

Glossary and Abbreviations

ADC	Ante-Natal Diagnostic Center
APCC	Adult Primary Care Clinic
AMIC	Acute Minor Illness Clinic
Catchment Area	The 40 mile area around a military hospital identifying funding for care of designated beneficiaries.
CHAMPUS	Civilian Health And Medical Program of the Uniformed Services
CQI	Continuous Quality Improvement program
ENT	Ear, Nose, and Throat clinic
GOPC	General Out-Patient Clinic
HFPA	Health Facility Planning Agency
JAG	Judge Advocate General
L&D	Labor and Delivery
MAMC	Madigan Army Medical Center
MRI	Magnetic Resonance Imagery
OB/GYN	Obstetrics and Gynecology
PAD	Patient Administration
PAU	Pre-Admission Unit
PTMS	Plans, Training, Mobilization, and Security Division
PTOT	Physical Therapy/Occupational Therapy

SEGD	Society for Environmental Graphic Design
TQM	Total Quality Management program
TRICARE	A Department of Defense triple option medical plan similar to a fee-for-service, preferred provider, and health maintenance organization program
Wayfinding	The act of processing spatial orientation cues inside an architectural facility (finding one's way)

APPENDIX A

Patient/Visitor Wayfinding Survey

Madigan Army Medical Center

Patient/Visitor Wayfinding Survey

Please take the time to fill out and return this short survey. We believe that your information is valuable and may make an important difference in how we serve you as our customer.

This survey will be used to find out your feelings about how well **wayfinding** (people finding their way) works at new Madigan. All information will be handled with strictest confidence. Please return your survey to the staff member who provided it and **thank you** for your help!

Date _____ Time _____ ☐AM ☐PM

Location or Clinic _____

Age _____ Sex: ☐male ☐female

Your status (☑ all that apply): ☐active duty ☐reserve ☐retiree
☐dependent ☐patient companion ☐visitor ☐other...(specify)_____

Are you permanently impaired in any way that would make finding your way difficult?
☐impaired locomotion ☐visual ☐deaf ☐other..._____

Is this your first visit here? ☐yes ☐no

If no, **about** how many times have you been here? _____

Which entrance did you use today? ☐medical mall ☐nursing tower ☐pediatrics
☐family practice ☐command entrance ☐emergency room ☐don't know
☐other (specify)_____

Did you have to ask for help to find this location? ☐yes ☐no

Did you experience difficulties finding your way **to this location** today? ☐yes ☐no

If yes, did you find it: ☐somewhat difficult ☐very difficult ☐extremely difficult

If you experienced difficulties, was it because of (☑ all that apply):

☐signs	☐destination was hidden
☐wall maps	☐couldn't find restrooms
☐directories	☐destination was poorly identified
☐handout maps	☐didn't know or couldn't understand name of clinic
☐building design	☐no help from staff

Did you have trouble finding your way to other Madigan locations today? ☐yes ☐no

If yes, which locations and why?

_____

_____

_____

Would you prefer for a clinic to be named...(place a ☑ in the column of your choice):

☐Ear, Nose, and Throat Clinic	or	☐Otorhinolaryngology Clinc
☐Lab or Laboratory	or	☐Pathology
☐Radiology	or	☐X-Ray Clinic
☐Ante-natal Diagnostic Clinic	or	☐Ultrasound Clinic

Is ease in finding your way through Madigan important to you?

☐very important
☐somewhat important
☐no feelings
☐somewhat unimportant
☐very unimportant

If you could go to a local civilian facility at no extra cost or a nominal cost, would you go there **because of any difficulty** you have experienced at Madigan **in finding your way**? ☐yes ☐no

List (in priority) the three Madigan locations you visit the most:

1._____ Did you have difficulty finding it? ☐yes ☐no
2._____ Did you have difficulty finding it? ☐yes ☐no
3._____ Did you have difficulty finding it? ☐yes ☐no

What are your comments about wayfinding at Madigan and how would **you** improve it?

If you are interested in offering more details (or possibly becoming involved in a focus group) on this subject, please leave your name and a number where you can be reached. Thank you again for your help!

APPENDIX B

Staff Wayfinding Survey

Madigan Army Medical Center

Staff Wayfinding Survey

Please take the time to fill out and return this short survey. We believe that your information is valuable and may make an important difference in how we can better serve you and the customer.

This survey will be used to find out your feelings about how well wayfinding (people finding their way) works at the new Madigan. All information will be handled with strictest confidence. Please return your survey to the staff member who provided it and **thank you** for your help!

Date _____ Time _____ ☐AM ☐PM

Location or Clinic _____

Age _____ Gender: ☐male ☐female Rank/Title _____

Your status (☑ all that apply): ☐volunteer ☐civilian ☐contractor ☐doctor ☐nurse
☐administrative ☐military ☐other...(specify) _____

How long have you been employed at this new facility? _____ years _____ months

Who visits this location?(☑ all that apply) ☐inpatients ☐outpatients ☐visitors ☐vendors
☐patient companions ☐employment applicants ☐other... _____

Who escorts inpatients here? _____

If outpatients are escorted here, who escorts them? _____

Where are customers coming from when they come to you? _____

Where do your customers go from here (where might they go)? (☑ all that apply)
☐X-ray ☐Pharmacy ☐Lab ☐PT/OT ☐PAD ☐other _____

To what location are people most often directed from here? _____

What is the single greatest traffic or directional problem for your department? _____

_____

What suggestions do you have to solve it? _____

Do people have trouble finding this location? ☐yes ☐no
Why?_____

Do patients, visitors, or others wander into this location asking directions? ☐yes ☐no

If yes, what are they searching for?_____

How often per day are you asked directions (here or elsewhere in Madigan)?_____

Do **you** get lost at Madigan? ☐yes ☐no
If yes, where?

_____

_____

_____

Are there major problems with existing signs in your area? ☐yes ☐no
If yes, please explain below.

What other suggestions do you have to improve wayfinding in Madigan?

If you are interested in offering more details (or possibly becoming involved in a focus group) on this subject, please leave your name and a number where you can be reached. You can also call MAJ Fred Gargiulo at 8-0162. Thank you again for your help!

APPENDIX C

Self Assessment Survey

Landmarks and layout

☐ Does your health facility's wayfinding system satisfy the orientation needs of first-time users? -
☐ Was the current wayfinding system planned or does it rely on a single element (like signs)?
☐ Does the system include such components as the layout of the building and site, interior and exterior landmarks, signs, terminology, color coding, floor and room numbering systems, directions, maps, directories, etc.?
☐ When possible, are related health facility functions located close to one another to simplify finding them?
☐ When a new health facility is designed, is the impact of the building's form on wayfinding specifically considered?
☐ Have interior landmarks been developed using the building's architecture as well as lighting, color, artwork, plants, etc.?

Floor and room numbering

☐ Do floor-number designations logically relate to the main entry floor and indicate if floors are above or below ground level?
☐ Are the relationships among floor numbers of linked buildings logical so that, for example, the second floor of one building does not link to the fourth floor of another?
☐ Are floors designated so that floor numbers can be used logically for each level - with, for example, all rooms on the fifth floor beginning with the number 5?
☐ Do rooms on the floors below the entrance level begin with a prefix likely to be understood by first-time users?
☐ Is the room-numbering system flexible enough to allow for future expansion without sequence disruption?
☐ Is the numbering system used consistently on all floors having similar uses and layouts?
☐ Have numbers needed by patients and visitors been differentiated from those used only by staff?
☐ Are major patient and visitor destinations identified primarily by name?
☐ If numbers are the primary means of room identification for patients and visitors, are the numbers large enough to be seen easier?
☐ Are patients' room numbers placed so that they are visible from hallways even when doors are open?
☐ Have letter and number combinations to identify spaces been avoided?
☐ If letters and numbers must be used, have letters (I. 0, V. etc.) that may be interpreted as numbers been avoided?
☐ Does the room-numbering system start as close as possible to the main entry point for that floor?
☐ Has the simplest numbering system been used?
☐ Are signs made out of materials that resist damage and are easily stocked and replaced as needed?
☐ Can room and telephone numbers be coordinated?

Terminology

☐ Have departmental names (pediatrics, radiology, etc.) been tested for patients' and visitors' comprehension?
☐ Is consistent terminology used on signs throughout the facility?
☐ Does each department use consistent terminology in written and verbal communication with patients and visitors?
☐ Have ambiguous terms been avoided?
☐ Are messages stated positively when possible?
☐ Is sign copy written at the sixth-grade reading level?

Symbols and pictographs

☐ Have symbols been tested for patients' and visitors' comprehension?
☐ Is the entire system of symbols coordinated so that styles, colors, shapes, and backgrounds remain consistent?
☐ Is the number of symbols used limited to just what's needed?
☐ Is there only one symbol per message?
☐ Are pictographs used only to supplement written information?
☐ Are arrows used only as directional indicators?

Mounting and typefaces

☐ Are the bottom edges of signs that project from the plane of the wall or that hang from the ceiling at least seven feet above the floor?
☐ Have sharp edges or exposed fasteners been avoided?
☐ Is lighting planned carefully to avoid glare on signs?
☐ Are signs placed to provide maximum visual exposure, especially along travel routes?
☐ Are both upper- and lower-case letters used to make signs easier to read?
☐ Have sans serif typefaces - those without extra ornamentation been used?
☐ Have words been aligned at the left-hand margin?
☐ Are letters two to three times larger than the minimal size necessary for a person with normal vision?
☐ Is the minimum letter size based on a ratio of 1 inch of letter height for each 25 feet of distance?

Spacing and locations

☐ Are sign locations determined in conjunction with mechanical and electrical fixtures, so that prime sign locations are not blocked?
☐ Are signs placed at major decision points along pathways?
☐ Do reassurance signs appear between 150 feet and 250 feet after major decision points, if another decision point has not yet been reached?
☐ Are directory panels placed in central locations?
☐ Is information, such as directory panels, located consistently so that people can always find it in certain places?

System maintenance

☐ Is one person in charge of managing and maintaining the healthfacility's signage system?

☐ If possible, has an easily accessible computerized database been developed for all signs, their locations, and messages?
☐ Can signs be changed easily without inviting vandalism?
☐ Is the signage system regularly reviewed for damage as well as validity?

Coloring

☐ Are colored floor lines used with other orientation aids as part of an overall wayfinding system?
☐ If a color system is used, does it consist of a small number of highly contrasting colors leading only to major destinations?
☐ Is color coding used logically and consistently?
☐ Have colored bands or lines been avoided as interior decoration in buildings where colored floor lines are used?

You Are Here Maps

☐ Do labels on maps correspond to identification signs on walls?
☐ Are maps placed near asymmetrical parts of the building so that people can key on some type of architectural feature as a memory aid?
☐ Are maps oriented so that forward is up - that is, is the direction that the person is facing while viewing the map at the top of the map?
☐ Are maps aligned with the building's layout?
☐ Are dominant architectural elements, such as landmarks incorporated into maps?
☐ Have maps been simplified by highlighting public corridors and destinations while de-emphasizing areas that are for use only by staff?
☐ Are insets provided to show the relationship of the mapped area to the rest of the facility?
☐ Are "you-are-here" arrows drawn so that they point in the direction and at the spot that viewers themselves face while looking at the map?

Giving Directions

☐ Has the facility instituted an ongoing staff-training program in giving directions so that they can be given as consistently and accurately as possible?

Amenities

☐ Are special graphics, murals, photographic enlargements, wall hangings. paintings, reproductions, and pictorial symbols used to create mood and to add color?
☐ Is any artwork located on ceilings of particular destinations to provide a focus for patients on gurneys?
☐ When possible, are corridors routed with views to landscaped areas, thus providing focus for attention and cues for wayfinding?
☐ Are windows provided along - rather than at the ends of -corridors?

Carpeting

☐ Have fire safety, stain resistance, static electricity, maneuverability of wheeled equipment, and antimicrobial finishes been considered when selecting carpeting for hallways and other public areas?

Lighting

☐ Has overlighting been avoided?
☐ Is corridor lighting arranged so that it does not shine in the eyes of patients on gurneys?
☐ Has an intimidating 'tunnel effect' - long corridors with good lighting only at the ends - been avoided?
☐ Is the color or intensity of lighting used to highlight information or meaningful spaces?

Handrails and seating

☐ Are handrails (or the handrail portion of bumper guards) between 1-1/4 inches and 1-1/2 inches in diameter and rounded on top and behind to fit a person's hand?
☐ Are handrails mounted 1-1/2 inches from the wall and 32 inches and 34 inches from the floor?
☐ Are seating alcoves provided where inpatients and outpatients might need them?

Unplanned uses

☐ Are there enough storage areas so that equipment can be easily placed out of sight?
☐ Is there sufficient conference room space where physicians and other medical personnel can hold impromptu meetings?
☐ Are there enough consultation rooms for rnedical staff to meet privately with family members?

Elevators

☐ Are elevator doors wide enough to accommodate stretchers, personnel, and equipment?
☐ Do elevator doors close slowly?
☐ Are floor designations indicated with raised numerals and Braile for visually impaired people?
☐ Are redundant cues - such as "l Main" - used for certain elevator-control buttons?
☐ If such buttons use letters to identify floors, are they accompanied by easily understood explanations?
☐ Are clear symbols and words used on buttons for "door open", "door close", and "emergency"?
☐ Are control buttons configured in an orderly way that reduces confusion?.
☐ Are control buttons within easy reach of patients and visitors in wheelchairs?
☐ Are floor indicators understandable and easy to read?
☐ Does elevator lighting cause glare on the cabs' floor-indicator displays?
☐ Are all of the elevator cabs constructed of damage-resistant materials?
☐ Are signs indicating which floor the elevator is on placed directly opposite the elevators doors and in clear view of those on board?
☐ Have metal tactile numbers for floor designation been installed on each floor 60 inches above the floor on the fixed point at open side of the elevator door or, when center-opening doors are used, on both sides?
☐ Outside the elevator, are call buttons with clear symbols for "up" and "down" used?
☐ Are easily understood lighted symbols provided to show when the cab is going up or down?
☐ Are places provided for patients and visitors to sit while waiting for elevators?
☐ Are there separate elevators for the public and outpatients, and for staff and inpatients?

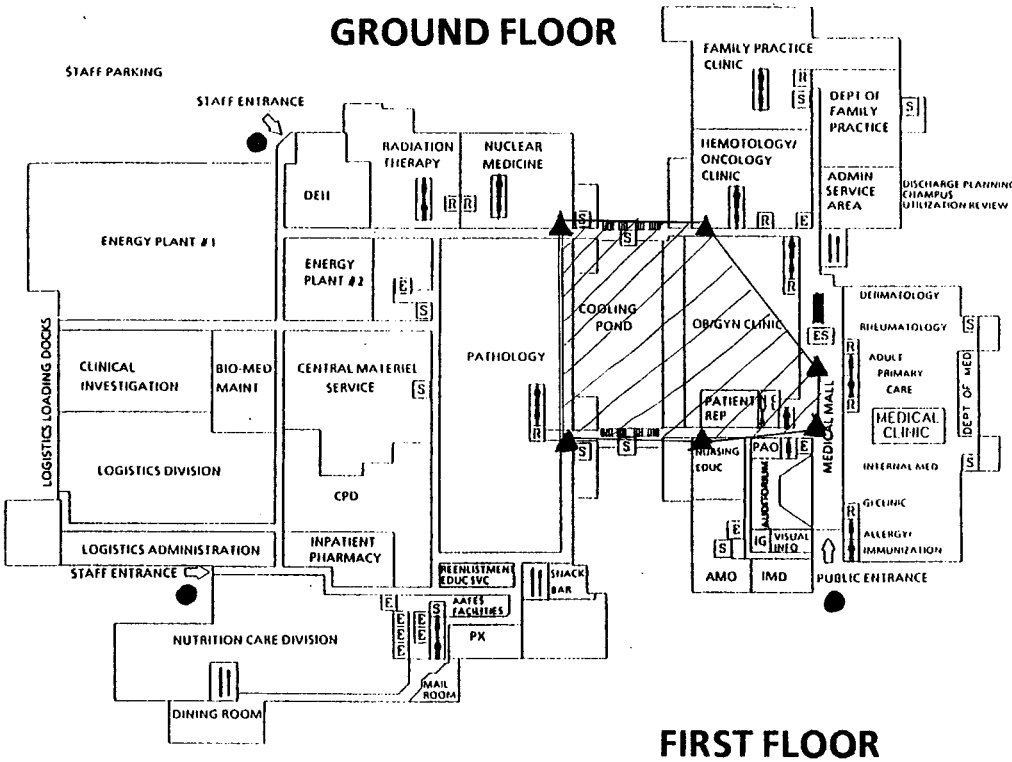
Stairways

☐ Have stairs with protruding treads or open risers been avoided?
☐ Are handrails 1-1/4 inches to 1-1/2 inches in diameter and mounted 1-1/2 inches from the wall?
☐ Are handrails provided on both sides of staircases?
☐ Do handrails extend beyond the first and last steps of staircases?
☐ Are stairways constructed of nonslippery materials?
☐ Do environmental factors - illumination, view, floor covering, etc. - remain the same throughout the same stairway?
☐ Are landings provided at frequent intervals?
☐ Is sufficient illumination (without glare or shadows) provided?
☐ Do visual cues distinguish stairway treads from risers?
☐ Has artwork been provided in stairwells to make them more interesting?

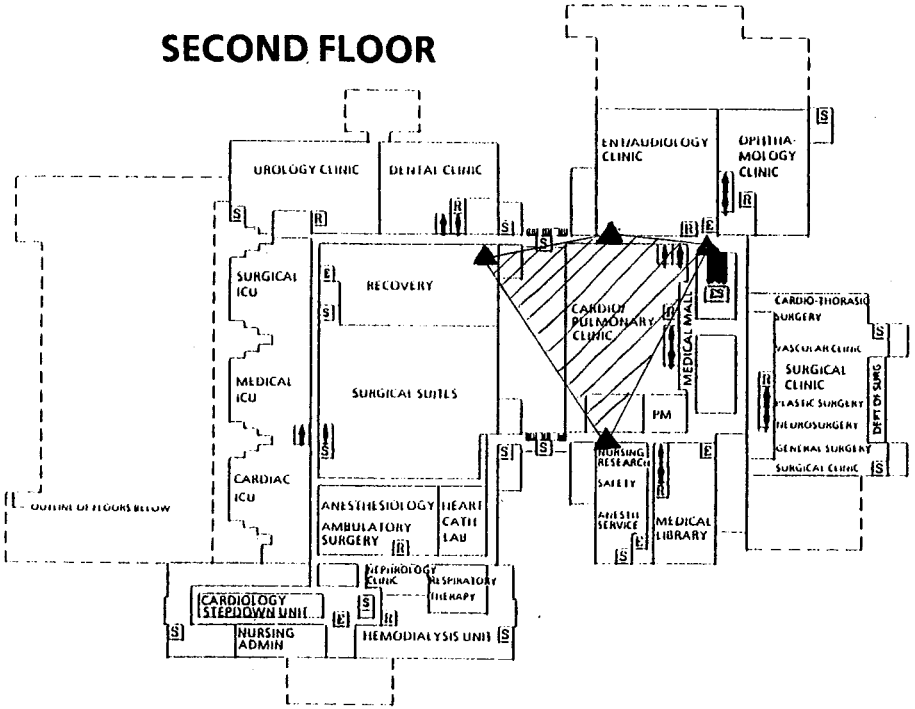
APPENDIX D

Wall Map and Entrance Locations

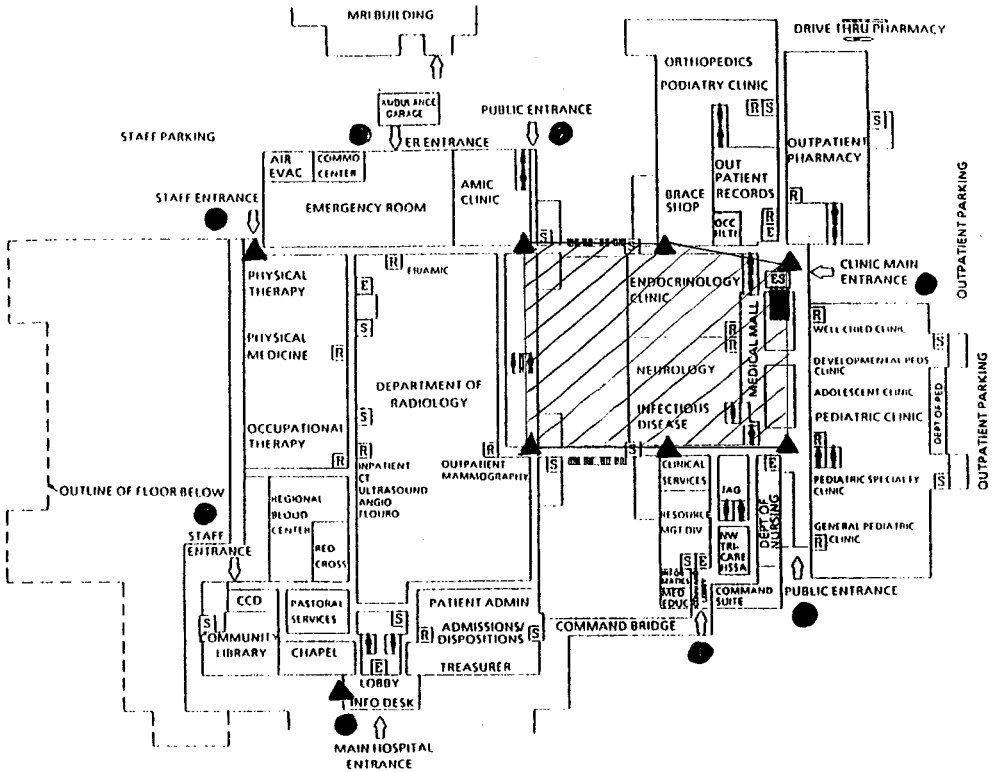
GROUND FLOOR



SECOND FLOOR



FIRST FLOOR



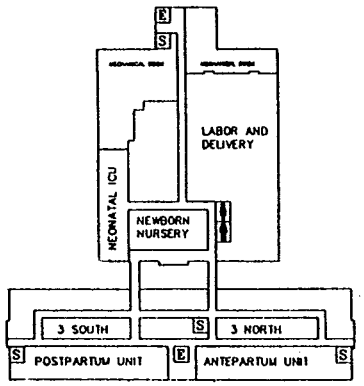
NEW MADIGAN ARMY

MEDICAL CENTER

▲ - Wall Maps

● - Entrances

THIRD FLOOR

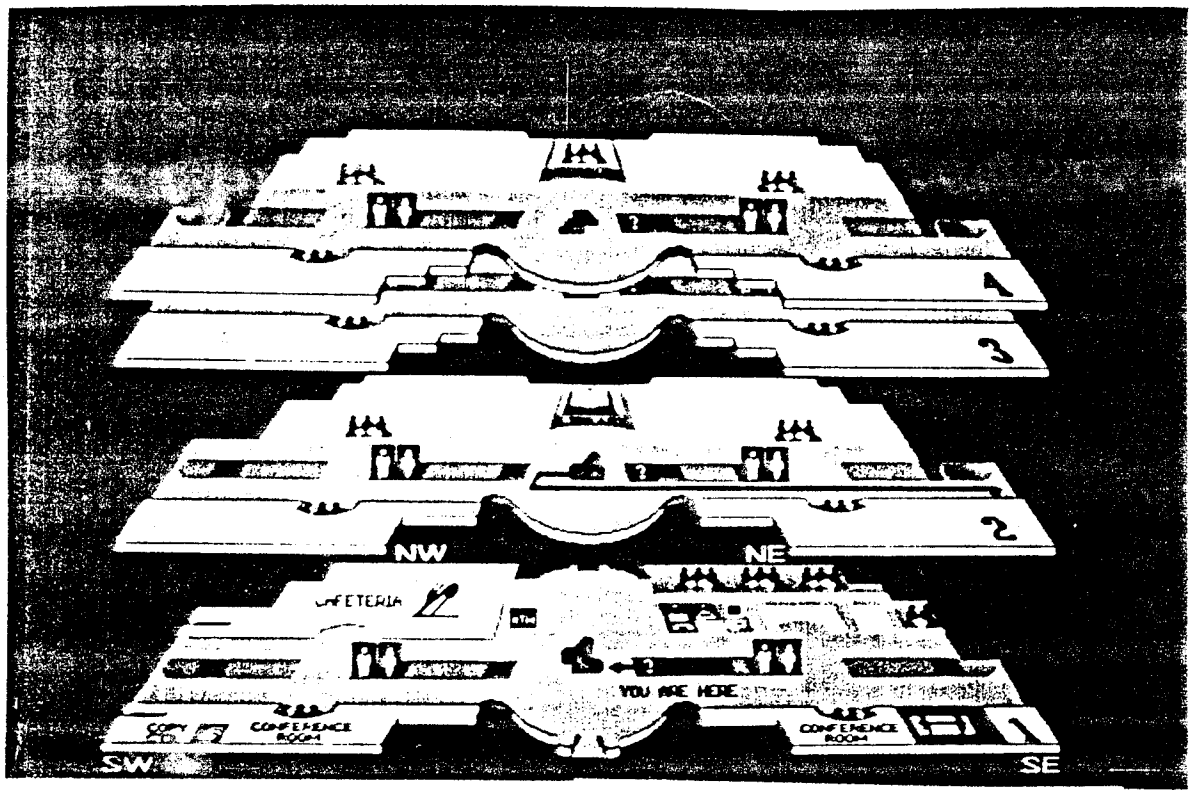


KEY:

- STAIRS
- ELEVATORS
- ESCALATOR
- RECEPTION
- RESTROOMS
- FOOD/VENDING

APPENDIX E

Example of 3D Map

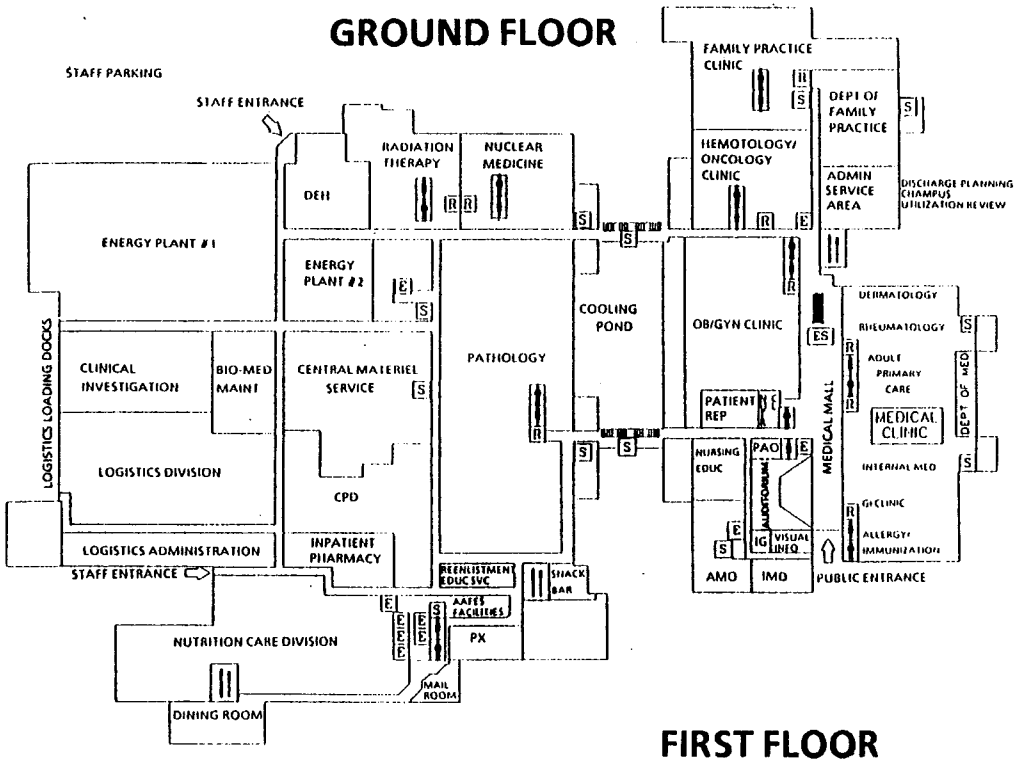

1
3
2
NW
NE
CAFETERIA
YOU ARE HERE
COPY
CONFERENCE ROOM
CONFERENCE ROOM
SW
SE

APPENDIX F

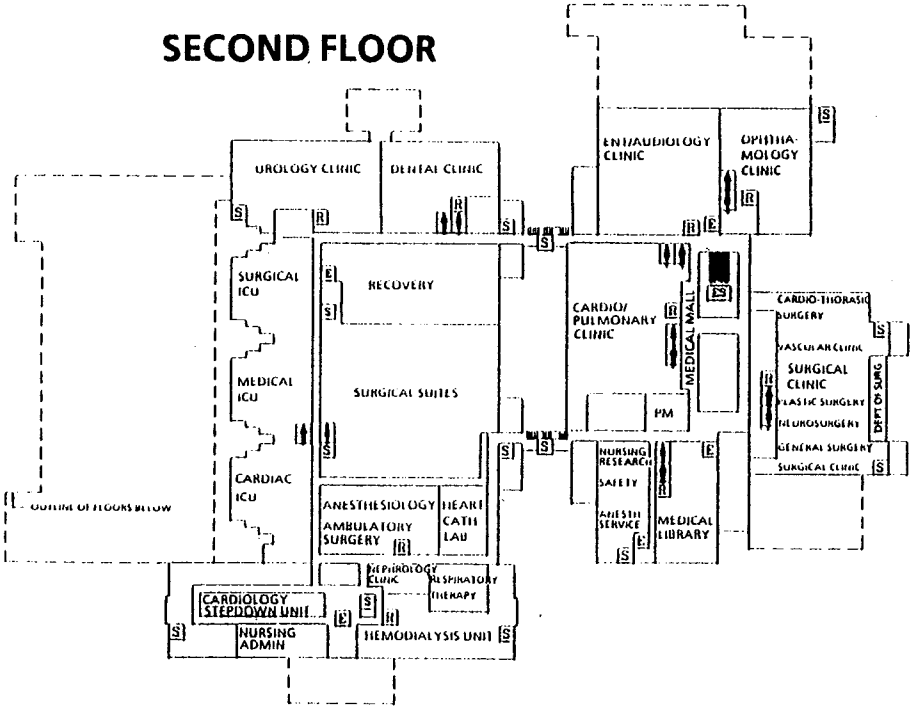
Facility Map

NEW MADIGAN ARMY MEDICAL CENTER

GROUND FLOOR



SECOND FLOOR



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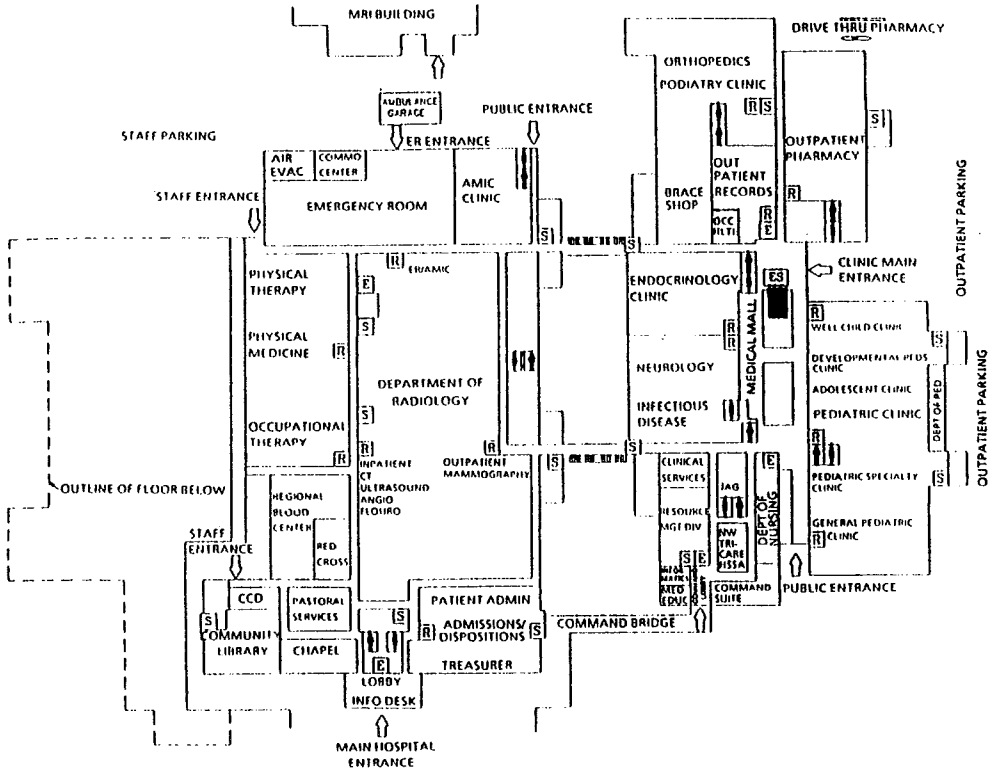

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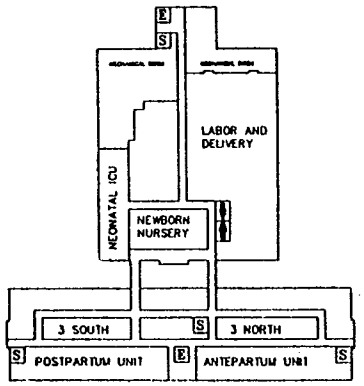


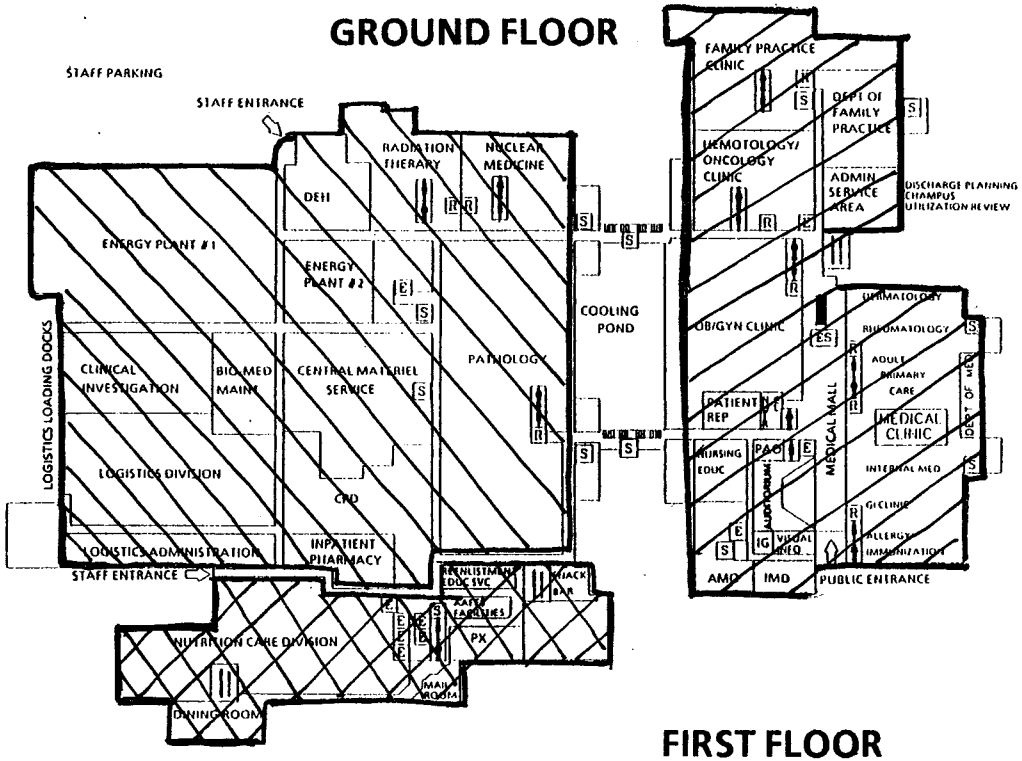
KEY:

- STAIRS
- ELEVATORS
- ESCALATOR
- RECEPTION
- RESTROOMS
- FOOD/VENDING

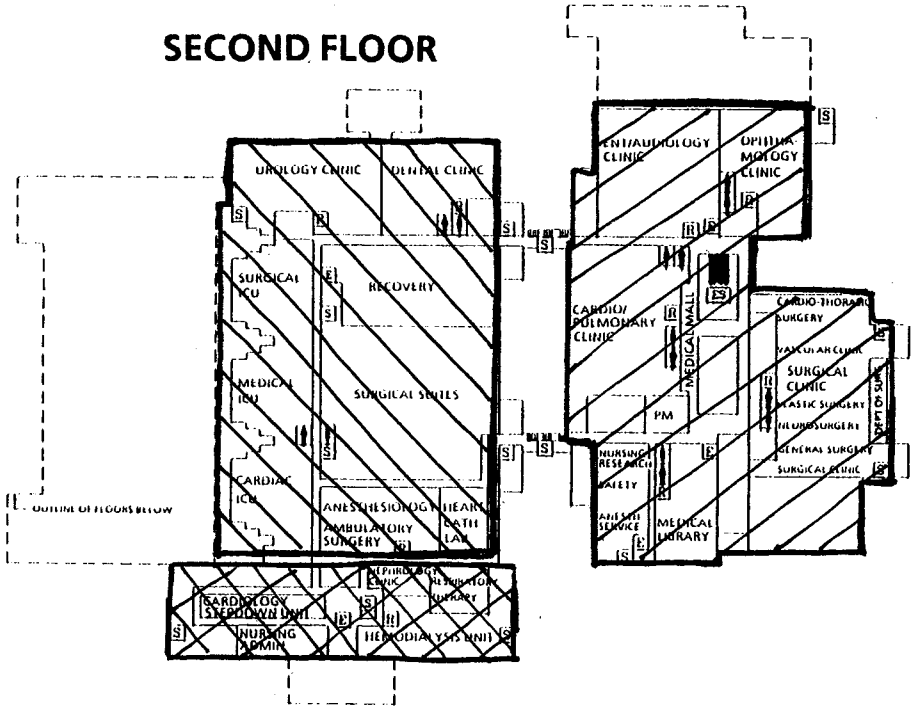
APPENDIX G

Map of Survey Grouping

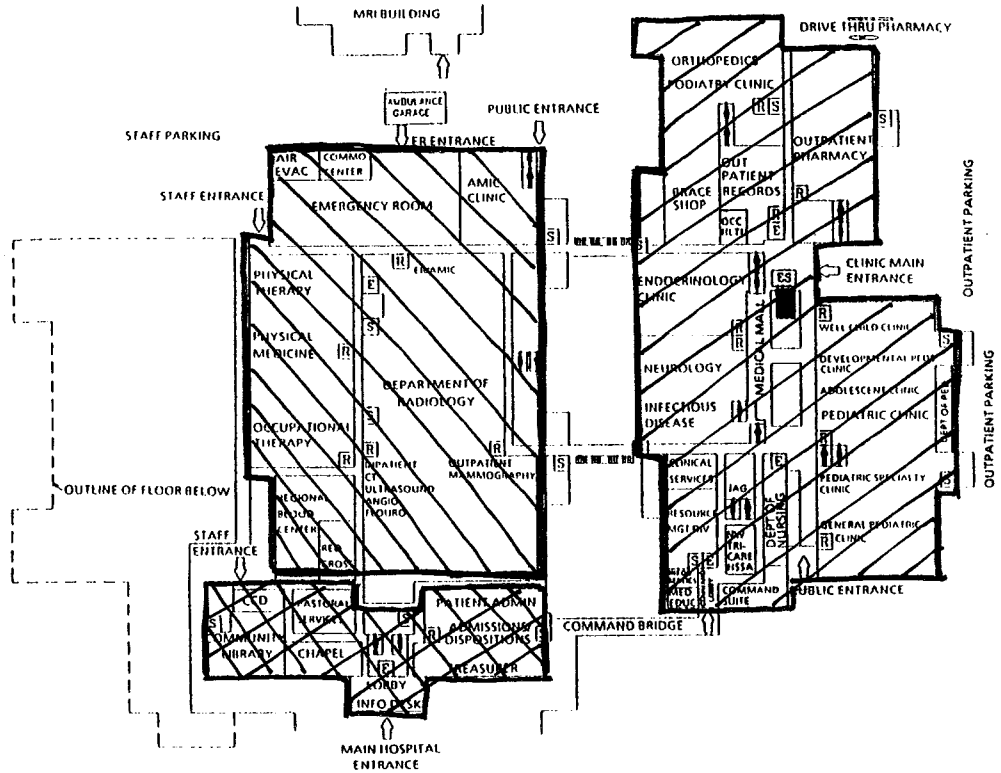
GROUND FLOOR



SECOND FLOOR



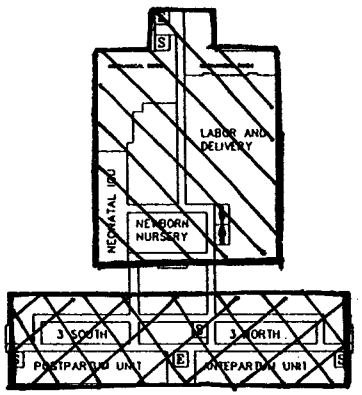
FIRST FLOOR



NEW MADIGAN ARMY

MEDICAL CENTER

THIRD FLOOR



- Ancillary
- Medical Mall
- Nursing Tower

KEY:

S	STAIRS
E	ELEVATORS
ES	ESCALATOR
R	RECEPTION
	RESTROOMS
	FOOD/VENDING

APPENDIX H

Decision Matrix

Decision Matrix

	Variables		Weight (Wj)				COA 1				COA 2		
			7-Point	Coded	Rescaled		Electronic system				Re-sign the facility		
Vj	Criteria Item		Rating	Rating	Rating [Vj]		Value	% [Z]	% x Wj		Value	% [Z]	% x Wj
V1	focus group rating		6	2	11.76		1.00	0.20	2.35		2.00	0.40	4.71
V2	mutually reinforcing elements		5	1	5.88		No	0.00	0.00		No	0.00	0.00
V3	modular to existing system		6	2	11.76		Yes	0.25	2.94		No	0.00	0.00
V4	current design compatibility		5	1	5.88		Yes	0.25	1.47		No	0.00	0.00
V5	installation disruption		3	-1	-5.88		Low	0.09	-0.53		Hi	0.27	-1.59
V6	durability		5	1	5.88		Med	0.13	0.76		Hi	0.20	1.18
V7	ease of maintenance		5	1	5.88		Low	0.10	0.59		Med	0.20	1.18
V8	ease of use		7	3	17.65		Med	0.14	2.47		Hi	0.21	3.71
V9	ease of expandability		5	1	5.88		Hi	0.27	1.59		Low	0.09	0.53
V10	flexible to change		7	3	17.65		Hi	0.27	4.76		Low	0.09	1.59
V11	accessibility to users		7	3	17.65		Low	0.07	1.24		Hi	0.20	3.53
V12	perpendicular visibility		7	3	17.65		Low	0.10	1.76		Hi	0.30	5.29
V13	stand alone ability		6	2	11.76		Yes	0.20	2.35		Yes	0.20	2.35
V14	space requirement		3	-1	-5.88		Yes	1.00	-5.88		No	0.00	0.00
V15	cost-purchase		1	-3	-17.65		Hi	0.27	-4.76		Hi	0.27	-4.76
V16	cost-consumables		3	-1	-5.88		Yes	0.50	-2.94		No	0.00	0.00
V17	cost-contract		1	-3	-17.65		Yes	1.00	-17.65		No	0.00	0.00
V18	appearance		6	2	11.76		Hi	0.25	2.94		Med	0.17	2.00
V19	gadgetry		5	1	5.88		Yes	1.00	5.88		No	0.00	0.00
			Sum	17	100.00			*Ci* =	-0.65				19.71
	Scale Factor =		S. F.=	5.88									

Decision Matrix

	COA 3			COA 4			COA 5			COA 6			Total
	Street signs w/ maps			Colored floor lines			Fix existing errors			Do nothing			
Vj	Value	% [Z]	% x Wj	Value	% [Z]	% x Wj	Value	% [Z]	% x Wj	Value	% [Z]	% x Wj	
V1	1.00	0.20	2.35	0.00	0.00	0.00	1.00	0.20	2.35	0.00	0.00	0.00	1.00
V2	Yes	0.50	2.94	Yes	0.50	2.94	No	0.00	0.00	No	0.00	0.00	1.00
V3	Yes	0.25	2.94	Yes	0.25	2.94	Yes	0.25	2.94	No	0.00	0.00	1.00
V4	Yes	0.25	1.47	No	0.00	0.00	Yes	0.25	1.47	Yes	0.25	1.47	1.00
V5	Med	0.18	-1.06	Hi	0.27	-1.59	Med	0.18	-1.06	No	0.00	0.00	0.99
V6	Hi	0.20	1.18	Low	0.07	0.41	Hi	0.20	1.18	Hi	0.20	1.18	1.00
V7	Med	0.20	1.18	Low	0.10	0.59	Med	0.20	1.18	Med	0.20	1.18	1.00
V8	Hi	0.21	3.71	Med	0.14	2.47	Hi	0.21	3.71	Low	0.07	1.24	0.98
V9	Med	0.18	1.06	Low	0.09	0.53	Med	0.18	1.06	Med	0.18	1.06	0.99
V10	Med	0.18	3.18	Low	0.09	1.59	Med	0.18	3.18	Med	0.18	3.18	0.99
V11	Hi	0.20	3.53	Hi	0.20	3.53	Hi	0.20	3.53	Med	0.13	2.29	1.00
V12	Med	0.20	3.53	Low	0.10	1.76	Med	0.20	3.53	Low	0.10	1.76	1.00
V13	Yes	0.20	2.35	No	0.00	0.00	Yes	0.20	2.35	Yes	0.20	2.35	1.00
V14	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	1.00
V15	Low	0.18	-3.18	Low	0.18	-3.18	Low	0.09	-1.59	No	0.00	0.00	0.99
V16	Yes	0.50	-2.94	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	1.00
V17	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	1.00
V18	Med	0.17	2.00	Low	0.08	0.94	Med	0.17	2.00	Med	0.17	2.00	1.01
V19	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	No	0.00	0.00	1.00
			24.24			**12.94**			**25.82**			**17.71**	

WORKS CITED

Anonymous. 1982. New signs unsnarl hospital maze. *Hospitals* (16 October): 32-3.

Anonymous. 1987. Creating hospital designs - practical design tips. *Hospital Guest Relations Report* 2(April): 10-2.

Architectural Plates. "As Builts" AG Signage and graphics, plans and details. Volume 4.

Arthur, P and R. Passini. 1992. *Wayfinding: People, signs, and architecture.* New York: McGraw-Hill Book Company.

Carpenter, E. 1989. Wayfinding: Design breakthrough or trendy buzzword? *Print* 43(January/February): 92-5+.

Carpman, J., M. Grant, and D. Simmons. 1984. *No more mazes: Research about design for wayfinding in hospitals.* The University of Michigan.

_____. 1986. Design That Cares: Planning health facilities for patients and visitors. American Hospital Publishing, Inc.

Carpman, J. 1989. Achieving consumer-responsive health facility design. *Journal of Health Care Interior Design* 1: 45-53.

_____. 1990. Avoiding the hidden costs on ineffective wayfinding. *Health Facilities Management* 3(April):28-37.

_____. 1991. Wayfinding in health care: 6 common myths. *Health Facilities Management* 4(May):24-8.

Eubanks, P. 1989. Wayfinding: More than just putting up signs. *Health Facilities Management* 6(June):20-5.

FED-STD-795. 1988. Uniform Federal Accessibility Standards: 1 April.

Grant, M. and J. Carpman. 1988. "Wayfinding" in Michigan hospitals. *Michigan Hospitals* 24(May): 45-7.

Gustafson, D., W. Cats-Baril, and F. Alemi. 1992. *Systems to support health policy analysis: Theory, models, and uses.* Ann Arbor, Michigan: Health Administration Press.

Kosterman, W. 1978. A guide to library environmental graphics. *Library Technology Reports* 14(May-June): 269-95.

Malkin, J. 1992. *Hospital interior architecture: Creating healing environments for special patient populations.* New York: Van Nostrand Reinhold.

MAMC Specifications. Volume 5. Division 10-13, Section 10440. Architecture Signage - Interior. Pages 10440-1 to -151.

Martin, B. 1993. Signage: Key (but not only) wayfinding element. *Health Facilities Management* (November): 62-6.

Medical Facilities Acquisition Board. 1993. Final report of the post occupancy evaluation Madigan Army Medical Center, Fort Lewis, Washington conducted 12-15 April 1993.

MIL-HDBK-1191. 1991. Department of Defense medical and dental treatment facilities design and construction criteria: 15 October.

Nowak, M. and S. Middleton. 1989. A case of innovation: The sign shop. *Hospital Materiel Management Quarterly* 3(February): 11-4.

OASD-PA. 1993. DoD will coordinate military health system changes with national reform efforts. (22 September news release from the Office of the Secretary of Defense - Public Affairs).

Proud, G. 1989. Pattern for navigation. *Health Service Journal* (June):696-7.

Reizenstein, J. 1982. Hospital design and human behavior: A review of the recent literature. *Advances in Environmental Psychology* vol. 4, ed. Andrew Baum and Jerome Singer. Hillsdale, NJ: Lawrence Earlbaum Associates, as quoted in Jain Malkin. 1992. *Hospital interior architecture: Creating healing environments for special patient populations.* New York: Van Nostrand Reinhold.

Roebuck, E., J. Manton, and G. Fordham. 1987. Building or extending a hospital department: Radiology, A path through the planning minefield (4). *Journal of the Royal Society of Medicine* 80 (April):239-45.

Saegert, S. 1970. Stress inducing and reducing qualities of environments. *Environmental psychology: People and their physical settings,* ed. W. H. Proshansky, W. H. Ittleson, and L. G. Rivlin, 2nd ed. New York: Holt, Rinehart, and Winston, as quoted in Jain Malkin. 1992. *Hospital interior architecture: Creating healing environments for special patient populations.* New York: Van Nostrand Reinhold.

Scurlock, C. *Wayfinding in a complex architectural environment.* (Master of Architecture thesis, University of Washington, 1985).

Sommer, R. 1969. *Personal space.* New Jersey: Prentice-Hall, quoted in Jain Malkin. 1992. *Hospital interior architecture: Creating healing environments for special patient populations.* New York: Van Nostrand Reinhold.

Spivack, M. 1984. *Institutional settings.* New York: Human Sciences Press, as quoted in Jain Malkin. 1992. *Hospital interior architecture: Creating healing environments for special patient populations.* New York: Van Nostrand Reinhold.

Veney, J. and A. Kaluzny. 1991. *Evaluation and decision making for health services.* 2d ed. Ann Arbor, Michigan: Health Administration Press.

Warner, D. and D. Holloway. 1978. *Decision making and control for health administration.* Ann Arbor, Michigan: Health Administration Press.

Weisman, G. 1989. Designing to orient the user. *Architecture* (October): 113-4.

Womack, D. 1992. Ten leadership steps to a smooth facility upgrade. *Military Medicine* 157(October): 511-4.

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5. FUNDING NUMBERS

6. AUTHOR(S)
Major Frederick J. Gargiulo, MS

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13. ABSTRACT *(Maximum 200 words)*

Madigan Army Medical Center, the newest Department of Defense tertiary care teaching center, was identified as having a problematic wayfinding system be several sources. Wayfinding, a relatively new term used to describe the act of processing spatial orientation cues inside an architectural facility (finding one's way), has amassed a considerable amount of literature in a short time span. A Post Occupancy Evaluation of the facility suggested further study on the issue. Two survey instruments were designed to assess the current status and magnitude of the problem and were administered throughout the entire facility. Responses from the patient and visitor survey (N1=875) and from the staff survey (N2=147) provided useful information on trends, problem areas, customer insights and preferences, and suggestions for improvement. A self assessment checklist on wayfinding found in the literature was also used to identify problem areas, validate trends in the surveys, and suggest improvements. Six courses of action were developed to address the identified problems. These alternatives were evaluated via a weighted, multi-criteria decision matrix. Nineteen criteria were developed from the literature and staff input. The "best" alternative, as identified by the decision matrix, was developed, with additional recommendations to the Executive Committee.

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